



**RioTinto**

# Warramboo & Mesa B / C Visual Impact Assessment



	<b>Name</b>	<b>Signature</b>	<b>Date</b>
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# Summary

The Rio Tinto Iron Ore GIS Team conducted the Visual Impact Assessment (VIA) for the proposed changes to the Warramboos mine & the proposed Mesa B/C Iron Ore Mine, located approximately 43 km west of Pannawonica. Field work was undertaken in July and August of 2016 and the assessment was undertaken as part of the environmental impact assessment for the proposed changes to the Warramboos mine site and for the proposed Mesa B/C mine development.

The VIA was conducted in three phases:

- Desktop Assessment (Analysis)
- Field Assessment (Photo Locations)
- Visual Impact (Photo Montage)

Results show present, operational and closure photo montages to illustrate the indicative visual impact of the proposed operations at Warramboos & Mesa B/C.



# Introduction

This report outlines the Warramboo & Mesa B/C VIA scope, methodology and results. The GIS Team was engaged to prepare a VIA report, which was developed in conjunction with several other environmental studies and reports to provide an overview of the likely impacts.

## 1.1 Objective & Scope

The overall objective was to assess the visual impact of the proposed mining operations at Warramboo & Mesa B/C and illustrate these impacts through photo montages. The key objectives were to:

- Analyse landscape within the development area
- Identify points of interest where potential impact may occur
- Conduct field trip to identified points to photograph
- Illustrate potential visual amenity impacts of mining stages through photo montages

## 1.3 Study Area

Warramboo & Mesa B/C is located approximately 43 km west of Pannawonica and is adjacent to the existing Mesa A/ Warramboo Mine (refer Map 1).

The North West Coastal Highway runs between the Warramboo and Mesa B/C project area and provides access tracks to the area. This road is sealed and is a heavy use highway of Western Australia.

The Robe River lies east and north-east of the Mesa B and to the east of Mesa C. Warramboo Creek lies south-west and west of the Warramboo project area (refer Map 2).

## 1.4 Regulatory Context

The following regulatory documents and relevant sections within them were consulted as part of this work to provide context and guidance on completing a Visual Impact Assessment.

Environmental Protection Authority (EPA) and the Environmental Protection Act 1986  
Amenity: "To ensure that impacts to amenity are reduced as low as reasonably practicable".

The Western Australian Planning Commission's (WAPC) State Planning Policy No. 2:  
Environment and Natural Resource Policy for Western Australia (WAPC 2003)  
"consider the need for a landscape or visual impact assessment for development proposals that may impact upon sensitive landscapes".

The WAPC's Pilbara Planning and Infrastructure Framework (WAPC 2012)  
"protect and manage the region's cultural heritage, arts including indigenous significant places, and landscapes of significance".

Figure 1

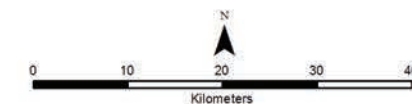
## Regional Location of Warramboo & Mesa B / C

Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

Proj: GDA 1994 MGA Zone 50  
Scale: 1:800,000 @ A4  
glisteam@riotinto.com

### Legend

- Mesa B & C
- Town
- ⊗ Rio Tinto Mine
- ⊕ Rio Tinto Port
- Rio Tinto Railway
- Highway
- Major Road
- Major Rivers



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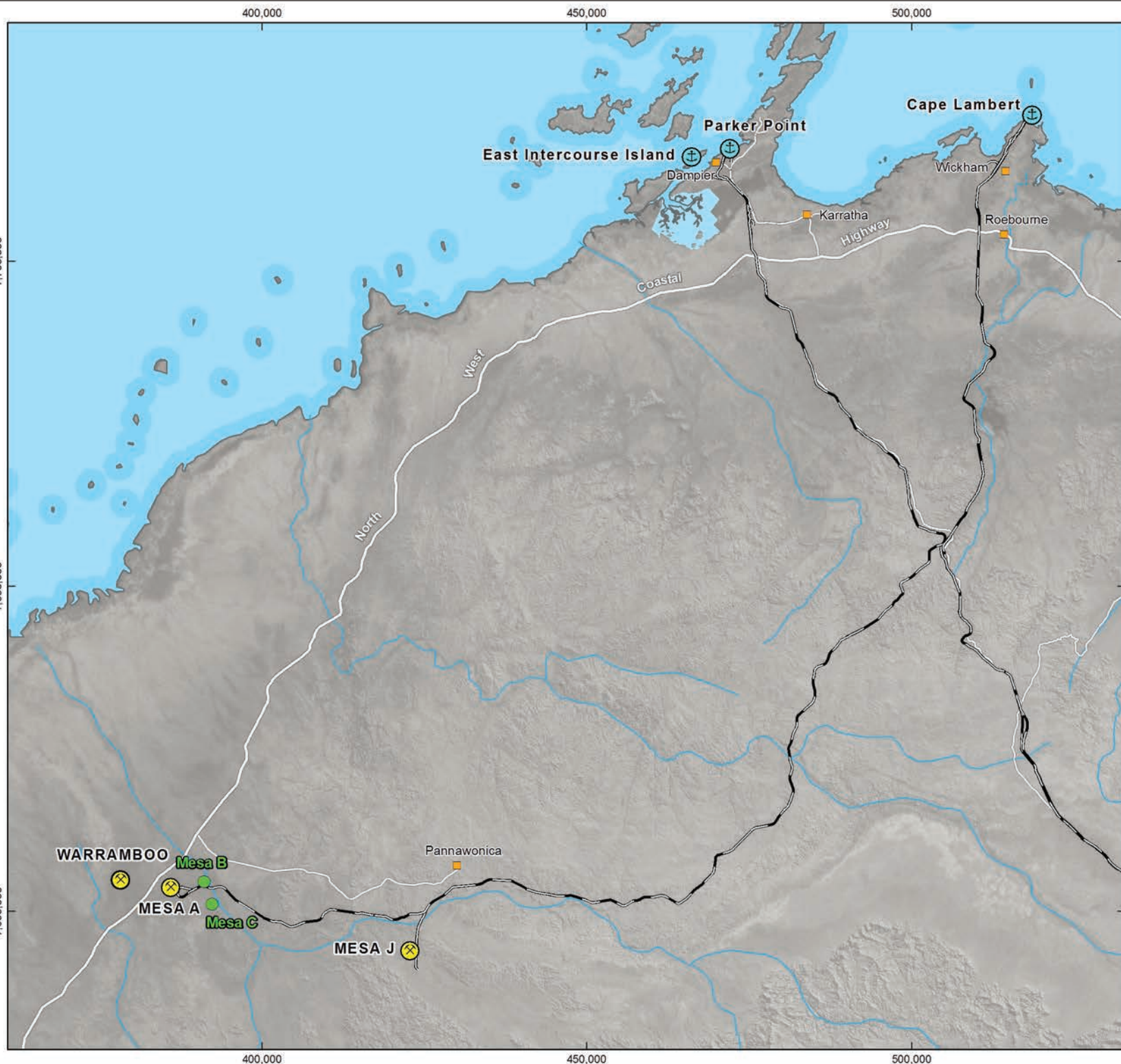




Figure 2

## Project Layout of Warrambo & Mesa B / C


Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

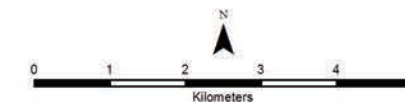
Proj: GDA 1994 MGA Zone 50  
Scale: 1:100,000 @ A4  
gisteam@riotinto.com

### Legend

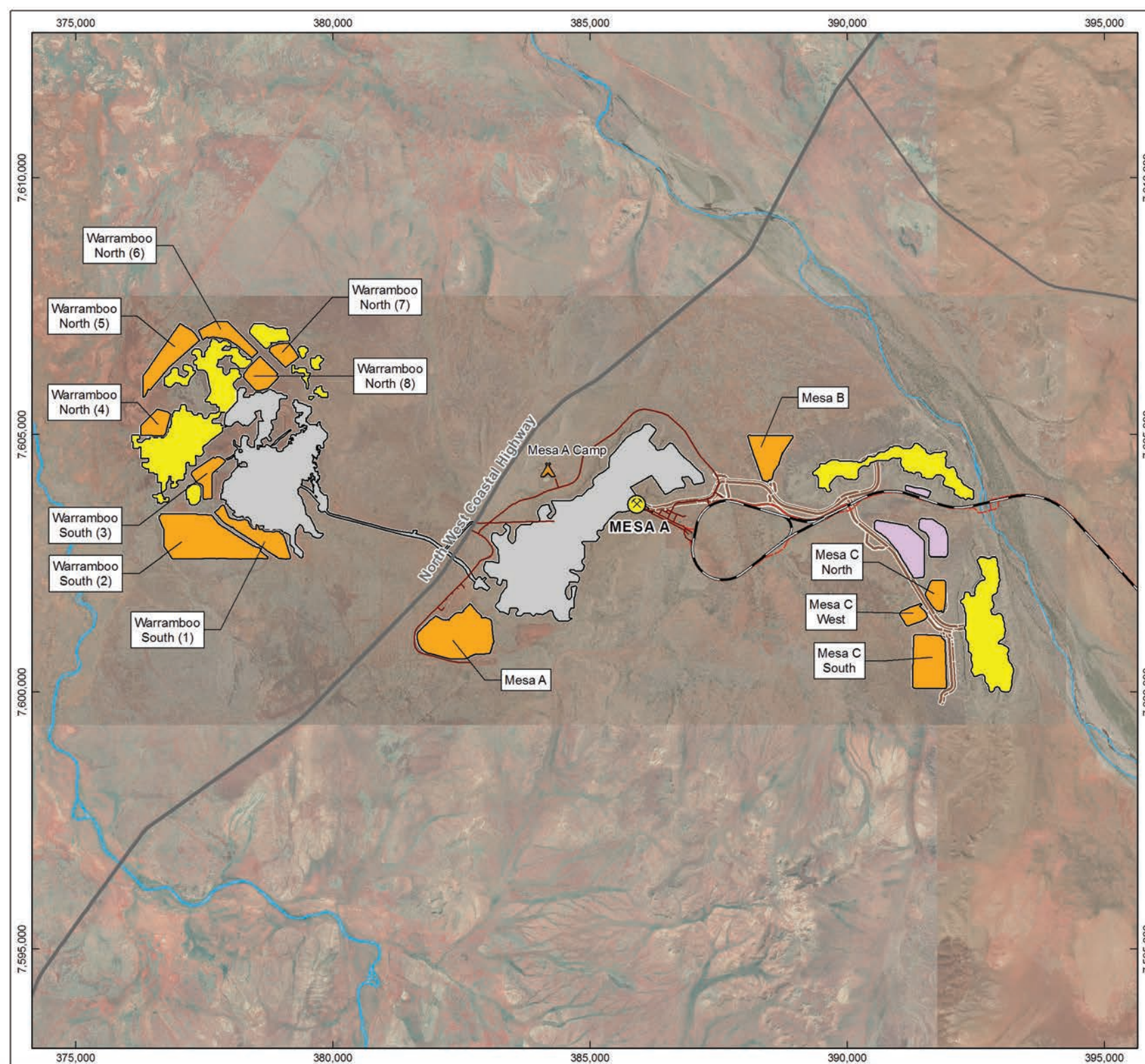
-  Rio Tinto Mine
-  Camp
-  Rio Tinto Railway
-  Highway
-  Major Road
-  Site Road
-  Rail Access Road
-  Major River / Creek

### Proposed Mine Layout

-  Pit
-  Waste Dump / Stockpile
-  Topsoil Stockpile
-  Current Operations
-  Haul Road



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# Methodology

The methodology used to assess the impact to the landscape and visual amenity was conducted in three phases. This process included the following:

## 2.1 Desktop Assessment

The aim the desktop assessment was to produce a terrain model of the study area with the proposed infrastructure overlaid. This model was then used to conduct a viewshed analysis using the proposed infrastructure to identify potential visual impacts across the model domain. The viewshed analysis output was then combined with existing spatial data such as heritage, environment and cadastral layers to guide the selection of locations for capture of images.

### Viewshed Analysis

To perform the viewshed analysis, the ArcGIS Viewshed tool within ArcMap was used. This tool can be found under Spatial Analyst > Surface > Viewshed within the Arc Toolbox.

A viewshed analysis identifies cells within a raster image (ASCII terrain model) that can be seen from any number of observer points or lines (infrastructure polylines). The identified cells are given a value of 1 for visible or 0 for not visible. This project had more than one observer point so more than 20 values have been entered. The viewshed analysis provides the starting point for all further visual impact assessment work.

The study area terrain model was created from LiDAR data and the proposed infrastructure data in Global Mapper and loaded into ArcGIS in ASCII format.

Figure 03: Viewshed Analysis Control Factors

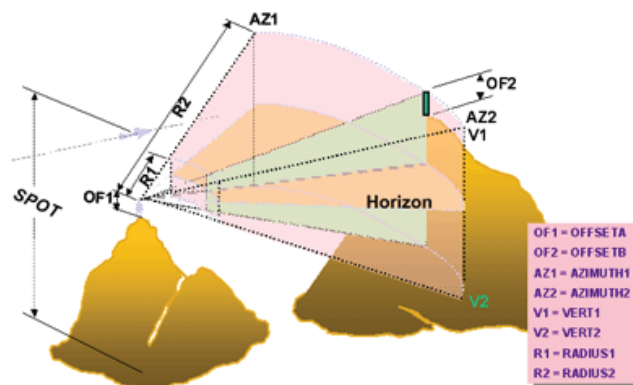
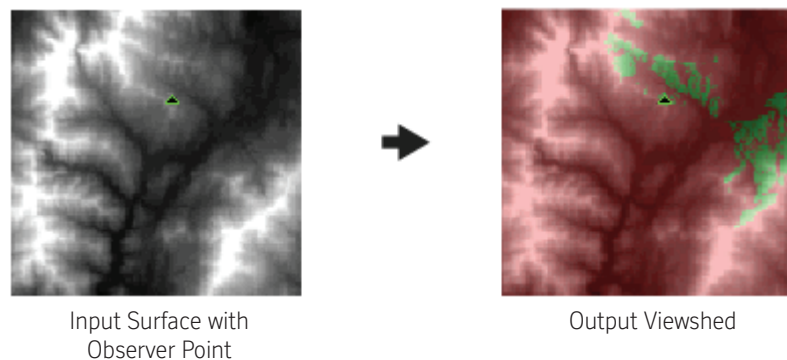


Figure 04: Viewshed Analysis Input vs Output



### Output

The viewshed analysis output was then used to create a cartographic map for the study team to easily identify potential visual impacts and help determine the locations for capture of photographs.

### Photo Location Selection

The study team consisted of Studies, Environment, Closure, Heritage and GIS. All teams worked together with GIS to identify and select locations for capture of images. Locations for the capture of images were selected based upon:

- proximity to significant heritage or environmental values
- line of sight to significant heritage or environmental values
- proximity to areas with public access

Traditional owner consultation was also undertaken to identify significant sites around the study area. Once all locations were selected, a field trip assessment was planned and undertaken over three days within the study area.

## 2.2 Field Assessment

Field assessment was conducted to take photographs from selected locations around the study area, with the photographic views focusing on the proposed infrastructure such as dumps and stockpiles. Comprehensive data collection was undertaken at each location to allow for photo montages to be produced in the next phase.

### Tools used in field work

Olympus Digital Camera E-330  
 Accessories: Tripod, Stabiliser, Compass, Measuring Tape  
 Trimble Juno 3B GPS  
 Iphone (Survey123 for digital data collection)  
 Paperwork (manual field notes)

### Field Trip

Field work was undertaken in conjunction with another Rio Tinto project for the purpose of Visual Impact Assessment, this occurred over two separate trips in July and August 2016.

Due to the cultural heritage significance of some of the photograph locations, Kuruma Marthudunera traditional owners escorted the field work team around the project area.

At each photograph location, assessment was made on the ground for accessibility and view aspect, which resulted in minor changes to photograph locations to ones agreed upon in desktop assessment. Once location and direction of photo was agreed, 3 photos of the same view were taken to reduce the risk of poor photo clarity and recorded both manually and digitally.

### Data Collection

The data shown in Table 1 were collected from each photograph location to assist in the next phase of the assessment.

**Table 1 - Data collected at each photograph location**

Site No. and Name	Identified in desktop assessment
Date/Time	Date and time of day
Photo Number	Unique photo number as multiple taken from each point
GPS Co-ordinates	Actual photo location for GPS unit
Bearing	Direction of the photo with the aid of compass
Camera Height	Height of the camera from ground level
Atmospheric Conditions	Weather and lighting
Description of View	Vegetation cover and infrastructure within the area
Comments	Additional detail

### Field Photos Review

Once field work was complete, the study team reviewed the adjusted photograph locations and selected photos that would best illustrate the potential visual impact.



## 2.3 Visual Impact Assessment process

Photo montages were generated from the photographs selected to best illustrate the potential visual impact of the proposed development. Generation of the photo montages involved a multistep process of data creation, view setup, image rendering, output and final mock up. Software required for this process were; Global Mapper, Microstation V8i, Adobe Photoshop and Adobe InDesign.

The following sections outline the process to create the final photo montage showing the current view, operational view and closure view along with any relevant supporting data.

### Exclusions

The conceptual pit and waste dump proposed at Highway / Tod Bore would require re-alignment of the North West Coastal Highway. As the preferred alignment of the North West Coastal Highway will not be known until after detailed consultation and mining at Highway / Tod Bore is not planned within the next five years. A visual impact assessment has not been done for the Highway / Tod Bore area. Topsoil stockpiles have not been included in the visual impact assessment as they are limited to 2m in height and will not remain at closure.

### Data

The terrain model created desktop assessment was used in the final phase to create surface features, for the purpose of lining up these features in the montage view.

The first feature captured was the bearing of the photo point (field data collection); then a 3D profile of the surface along the bearing alignment was created in 3D DXF line format (see Figure 03 & 04). Additionally, landmark topography in each photo was captured from the terrain model in 3D Mesh DXF format to assist in the final alignment. All photos required the bearing and at least two 3D Mesh DXF models to successfully line up the photo.

Figure 05: Global Mapper Model Bearing

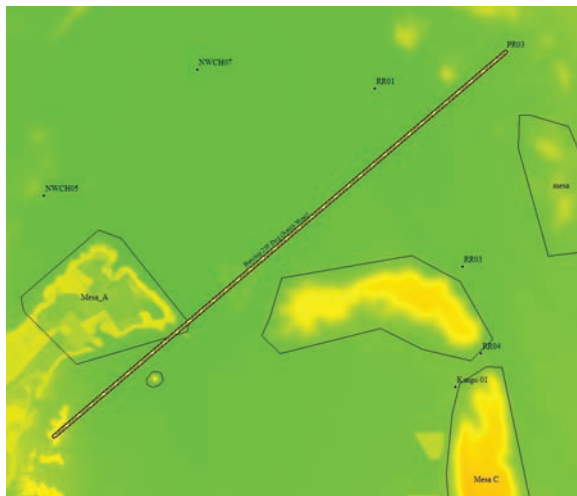
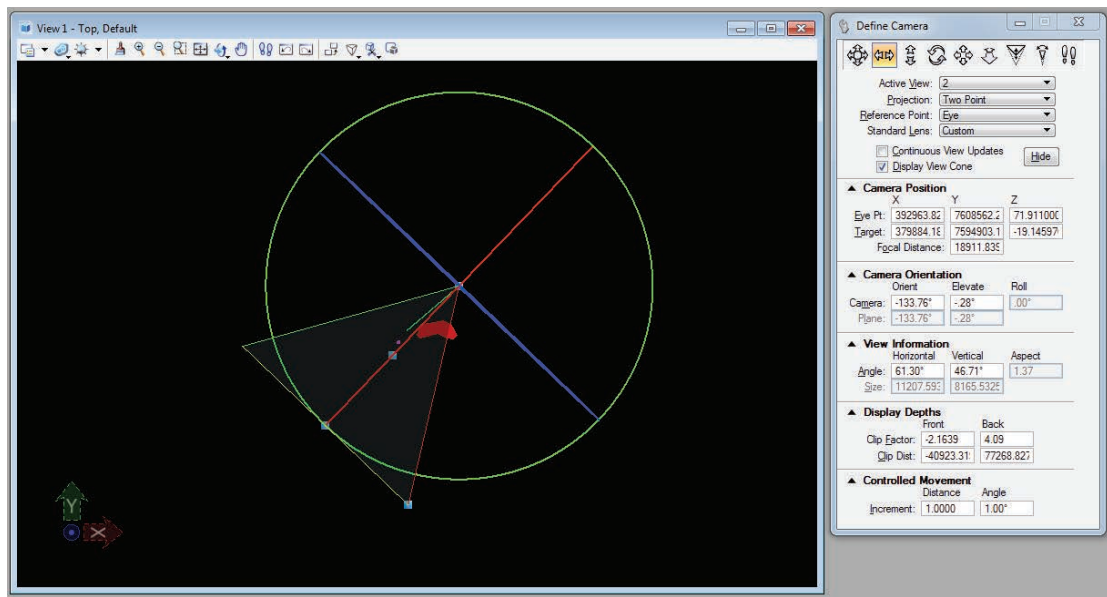




Figure 07: Microstation Construction View and Camera Define Tools



### Montage Setup

Once data were captured in Global Mapper, a montage was created in Microstation. The photo size was kept proportional to actual size, then a view was created in the image by using the Define Camera alignment tools in the construction view (see Figure 05).

The Define Camera alignment tools allowed the montage view to be altered by units distance and degrees in all directions which gave more control to exactly line up features in the image.

Figure 08: Montage View - after alignment completed



### Montage Rendering

The next step was to add the proposed infrastructure to the montage view in Microstation, these data were provided from the Mine Planning Engineers and converted to 3D Mesh DXF. The rendering tool was then applied to convert the proposed infrastructure line strings to surface areas (see Figure 07). The image was then exported from Microstation to a JPG format.

Figure 09: Rendered View



### Montage Output

To create the final image, the original photo was loaded into Adobe Photoshop and the rendered image from Microstation was overlaid to show the location of the proposed infrastructure. A realistic texture (of proposed infrastructure) was then placed under the original image and parts of the image were erased to expose texture in the proposed infrastructure location (See Figure 08). The final image was then exported from Adobe Photoshop to JPG format. A closure version was also created to show rehabilitated infrastructure.

Figure 10: Texture Exposed on Original Image in Adobe Photoshop



### Final Mock Up

The Current View, Operations View, Closure View were then combined into the final mock up in Adobe InDesign with location map and photo location details as the final output for the Visual Impact Assessment.

# Results

The results section outlines a description of the maps and figures produced during the Visual Impact Assessment. The final output produced 16 figures showing the potential visual impact of the Warramboos and Mesa B / C Project.

## 3.1 Desktop Assessment

The desktop assessment resulted in the output maps of the Infrastructure Actual Height, Viewshed Analysis and Photo Location. These assisted the team into the second phase of the Visual Impact Assessment.

Figure 11 - Project Layout (Actual Height of Infrastructure)

Figure 12 - Viewshed Analysis - Map shows the blue shaded area shows all locations where any component of the Mesa A Hub Proposal may be visible based on the topography of the area and the dimensions of the proposed infrastructure.

Figure 13 - Photo Location (Planned Location)

## 3.2 Field Assessment

Sites with the greatest potential for visual impact and sites of interest (such as views from the Robe River) were selected from the view shed analysis for field assessment. The field assessment resulted in a map of actual photo locations taken on the ground. These altered slightly from planned location in some cases due to access or view aspect. This data was used in the final phase of the Visual Impact Assessment.

Figure 14 - Photo Location (Selected for Visual Impact)

## 3.3 Visual Impact

The final result from this project was to show the visual impact of the Warramboos and Mesa B / C project, the following figures outline how each view will be impacted visually.

Figure 15 - North West Coastal Highway

Figure 23 - Pannawonica Road

Figure 16 - North West Coastal Highway

Figure 24 - Robe River

Figure 17 - North West Coastal Highway

Figure 25 - Robe River

Figure 18 - North West Coastal Highway

Figure 26 - Robe River

Figure 19 - North West Coastal Highway

Figure 27 - Robe River

Figure 20 - North West Coastal Highway

Figure 28 - Warramboos Creek

Figure 21 - North West Coastal Highway

Figure 29 - Warramboos Creek

Figure 22 - Pannawonica Road

Figure 30 - Kang



Figure 11

## Project Layout of Warrambo & Mesa B / C Actual Height





Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: October 2018

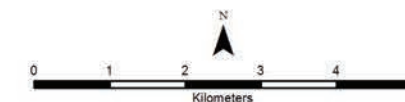
Proj: GDA 1994 MGA Zone 50  
Scale: 1:100,000 @ A4  
glisteam@riotinto.com

### Legend

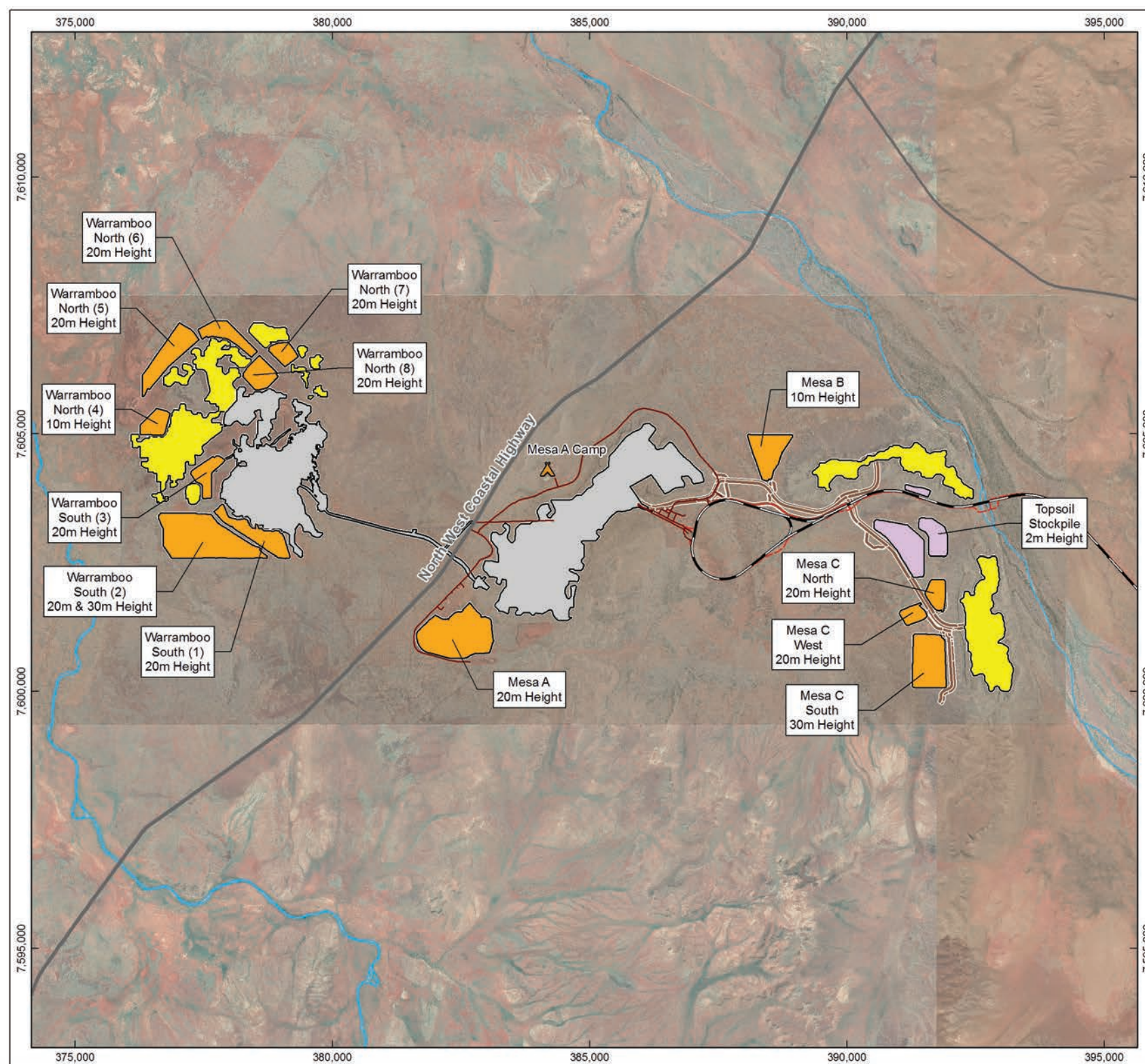
-  Camp
-  Rio Tinto Railway
-  Highway
-  Major Road
-  Site Road
-  Rail Access Road
-  Major River / Creek

### Proposed Mine Layout

-  Pit
-  Waste Dump / Stockpile
-  Topsoil Stockpile
-  Current Operations
-  Haul Road



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Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

Proj: GDA 1994 MGA Zone 50  
Scale: 1:175,000 @ A4  
gisteam@riotinto.com

#### Legend

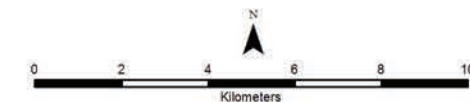
-  Rio Tinto Railway
-  Highway
-  Major Road
-  Site Road
-  Rail Access Road
-  Major River / Creek

#### Viewshed Analysis

-  Not Visible
-  Visible

#### Proposed Mine Layout

-  Pit
-  Waste Dump / Stockpile
-  Current Operations
-  Haul Road



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Figure 13

## Planned Photo Locations

Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

Proj: GDA 1994 MGA Zone 50  
Scale: 1:150,000 @ A4  
gisteam@riotinto.com

### Legend

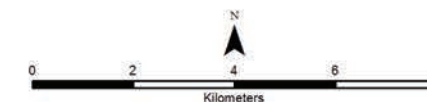
- Planned Photo Location
- Rio Tinto Railway
- Highway
- Major Road
- Site Road
- - - Rail Access Road
- Major River / Creek

### Viewshed Analysis

- Not Visible
- Visible

### Proposed Mine Layout

- Pit
- Waste Dump / Stockpile
- Current Operations
- Haul Road



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Figure 14

## Actual Photo Locations

Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

Proj: GDA 1994 MGA Zone 50  
Scale: 1:125,000 @ A4  
gisteam@riotinto.com

### Legend

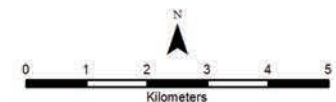
- Actual Photo Location
- Rio Tinto Railway
- Highway
- Major Road
- Site Road
- Rail Access Road
- Major River / Creek

### Viewshed Analysis

- Not Visible
- Visible

### Proposed Mine Layout

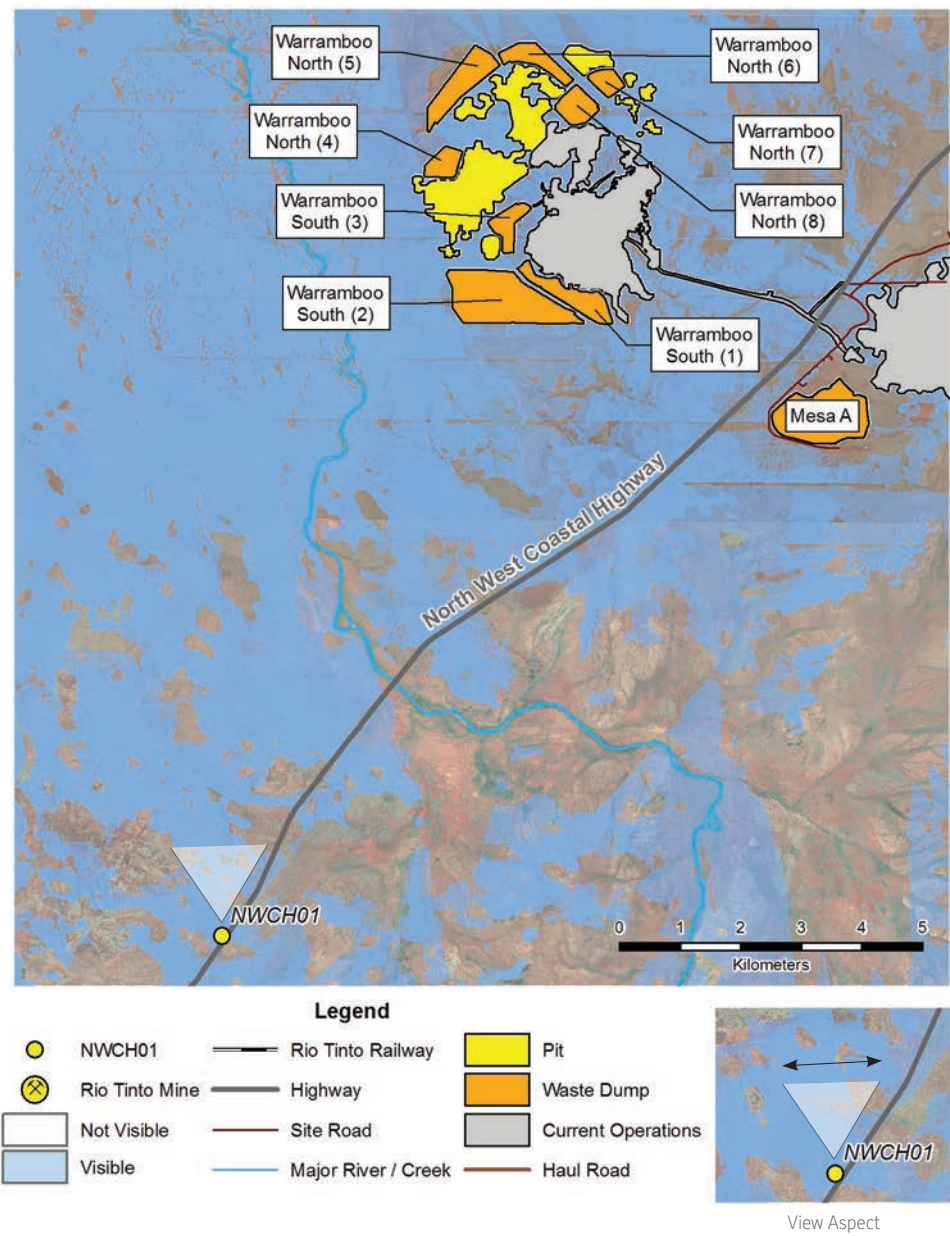
- Pit
- Waste Dump / Stockpile
- Current Operations
- Haul Road



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Location Map



Current View



Operations View



Closure View



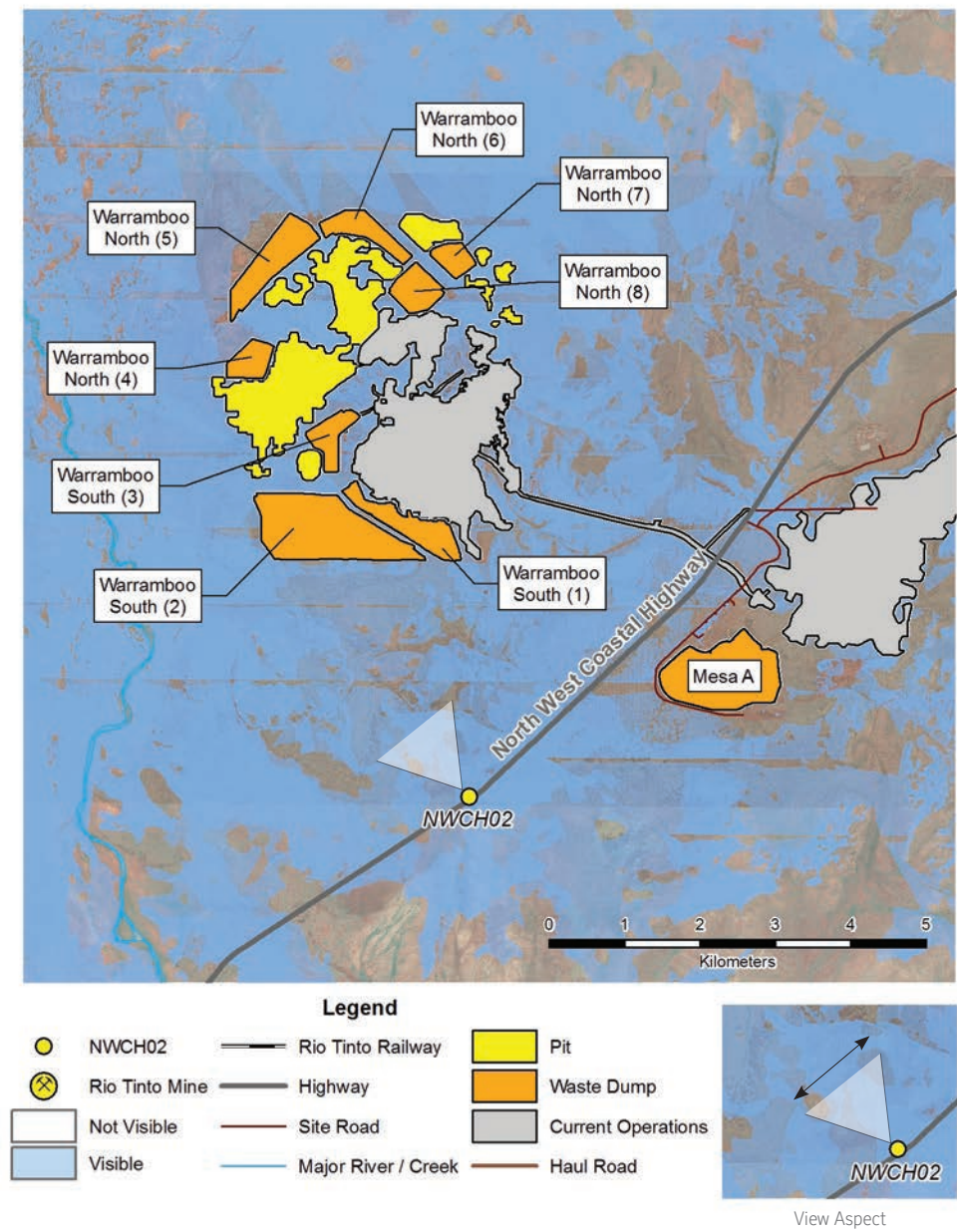
Viewpoint Characteristics

Name	#01 - NWCH01 - North West Coastal Highway
Co-ordinates	373,253.69mE / 7592477.71mN
Direction	North (Bearing 360°)
Description	Very flat ground with low vegetation coverage.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the western side of the Highway.

Figure 15 - North West Coastal Highway



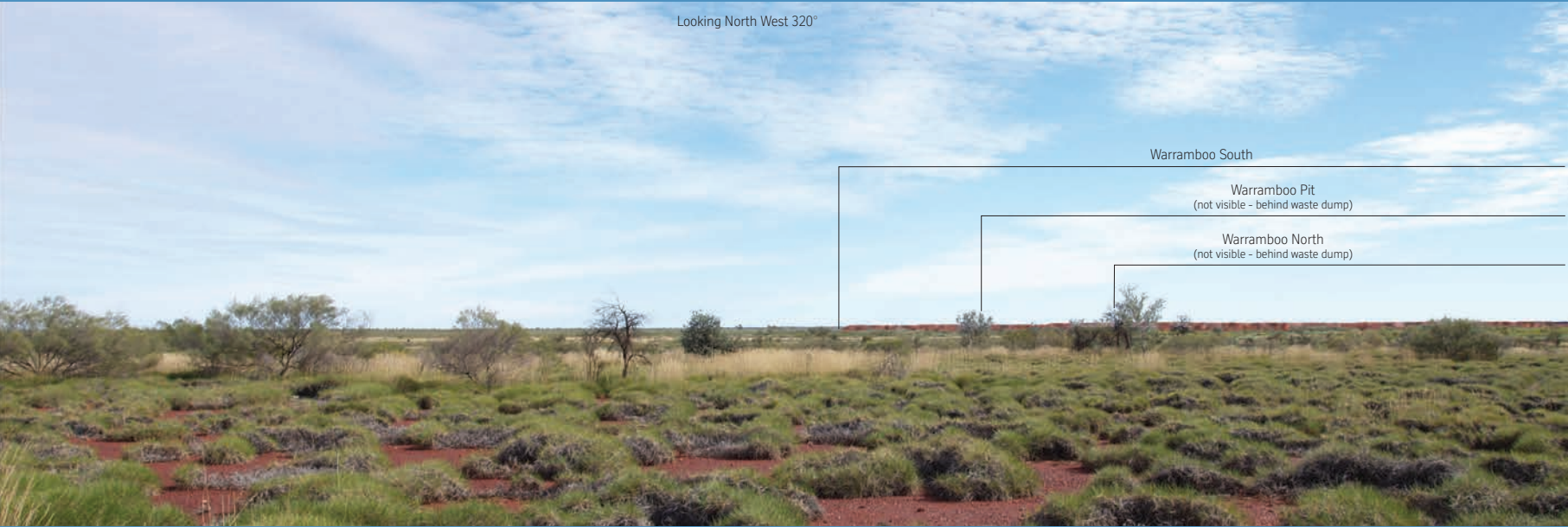
Location Map



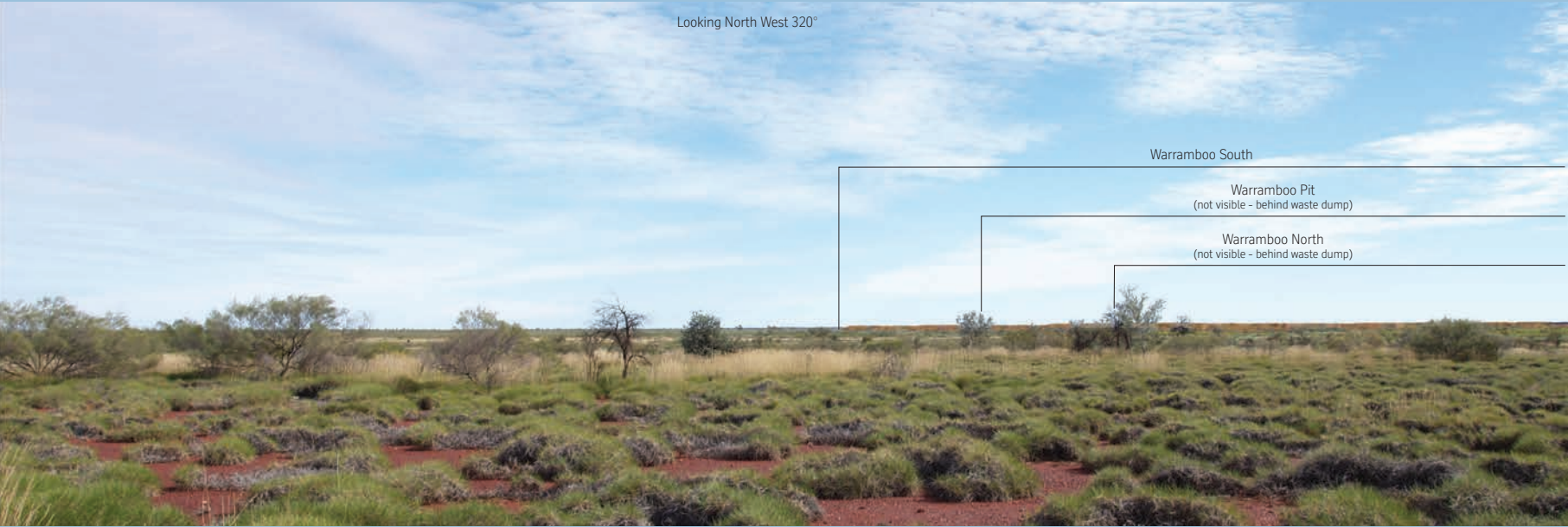
Current View



Operations View



Closure View



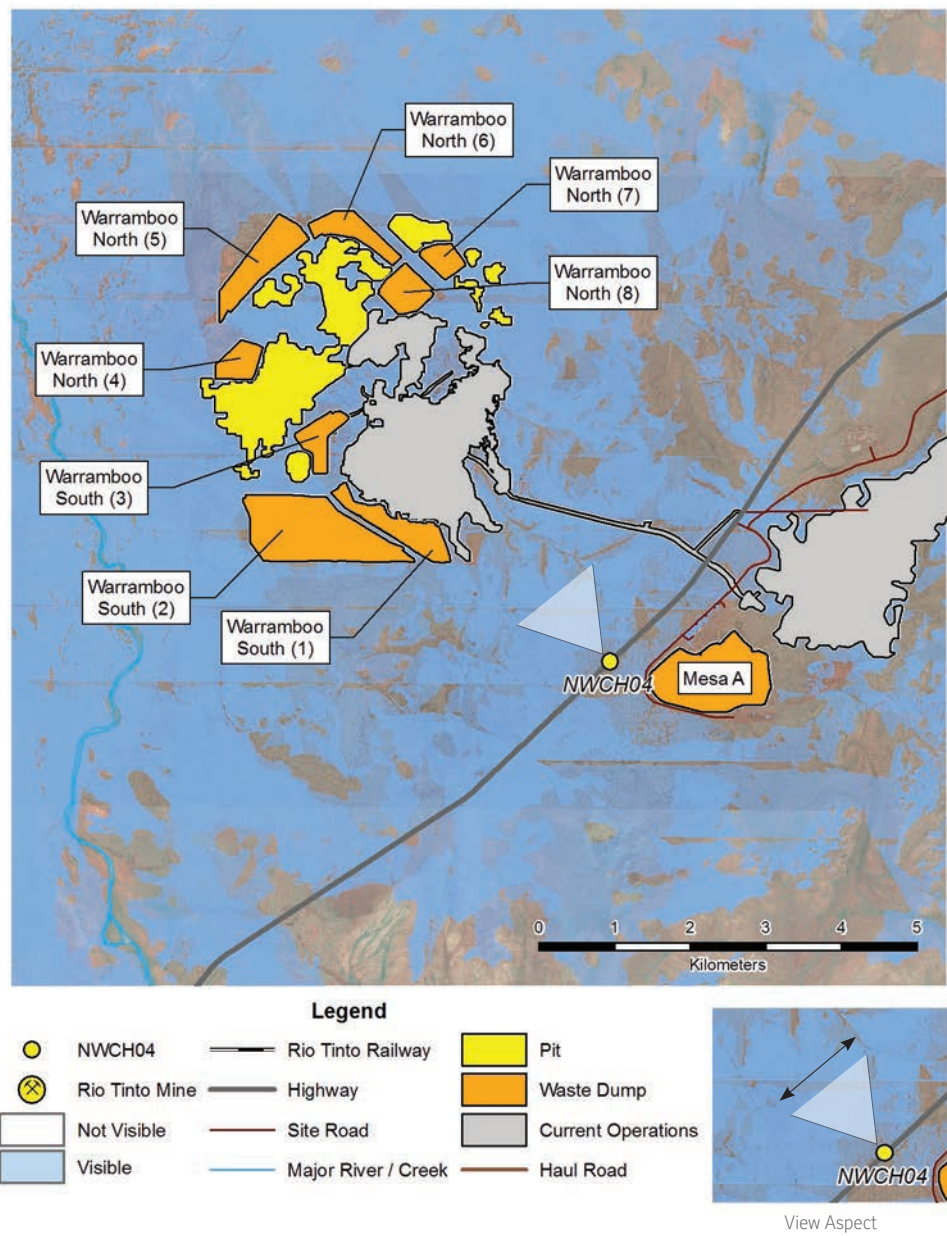
Viewpoint Characteristics

Name	#02 - NWCH02 - North West Coastal Highway
Co-ordinates	379302.53mE / 7599478.42mN
Direction	North West (Bearing 320°)
Description	Very flat ground with low vegetation coverage. Warrambo existing operations waste dump in right hand side of view.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the western side of the Highway.

Figure 16 - North West Coastal Highway



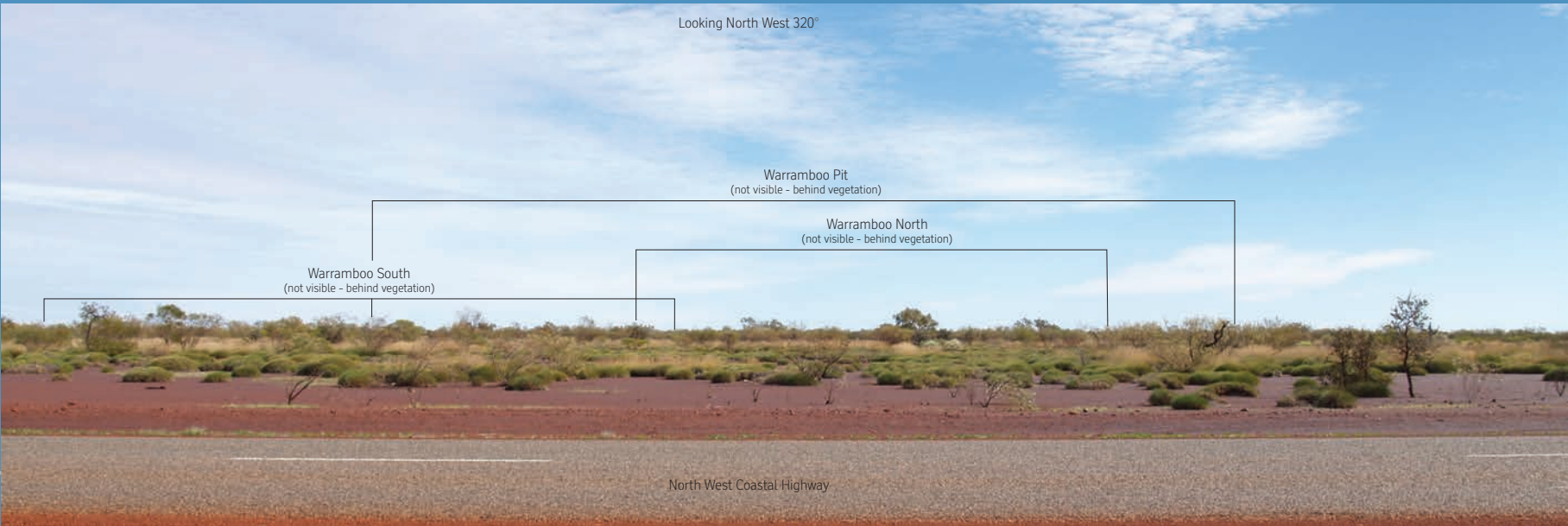
Location Map



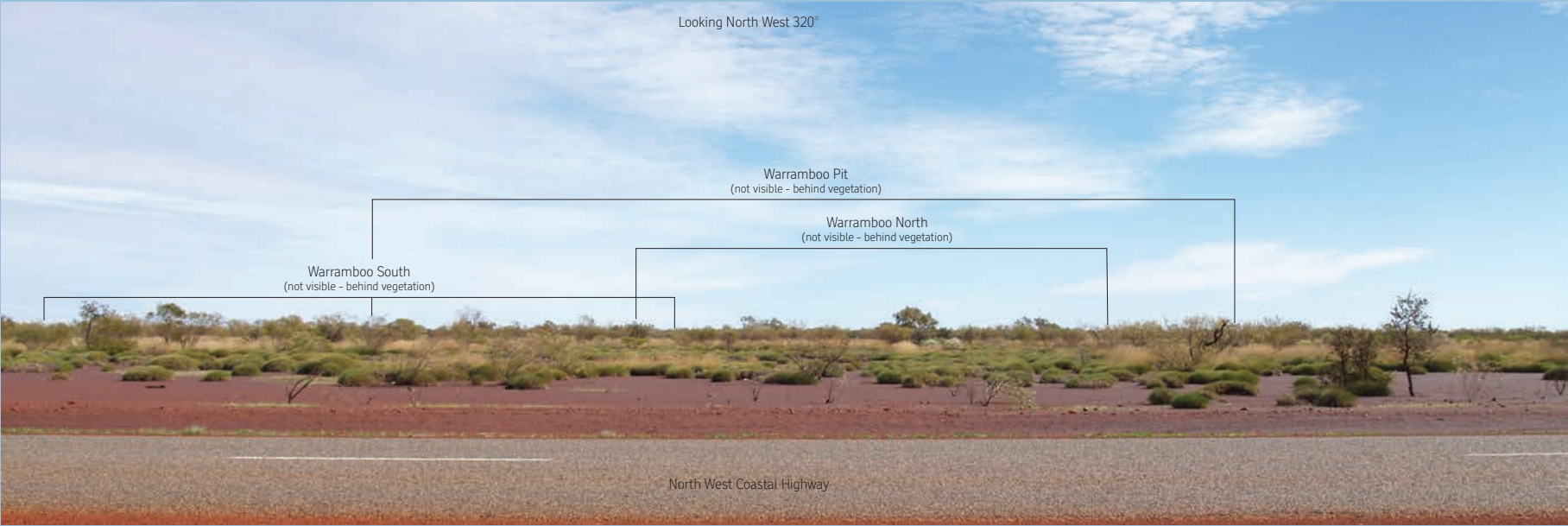
Current View



Operations View



Closure View



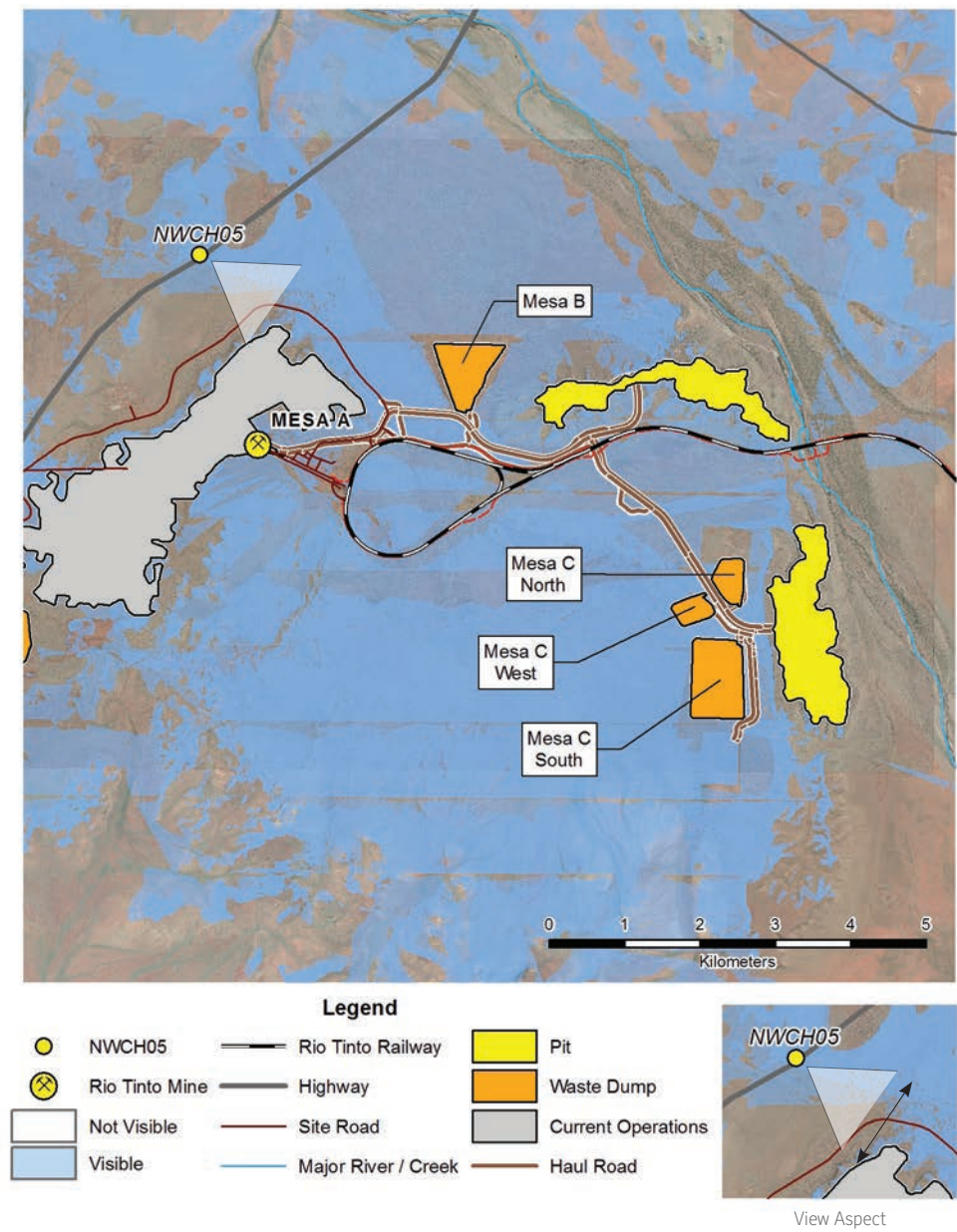
Viewpoint Characteristics

Name	#04 - NWCH04 - North West Coastal Highway
Co-ordinates	381145.69mE / 7601301.05mN
Direction	North West (Bearing 320°)
Description	Very flat ground with low vegetation coverage. Warramboo existing operations to the north west across the road.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the eastern side of the Highway.

Figure 17 - North West Coastal Highway



Location Map



Viewpoint Characteristics

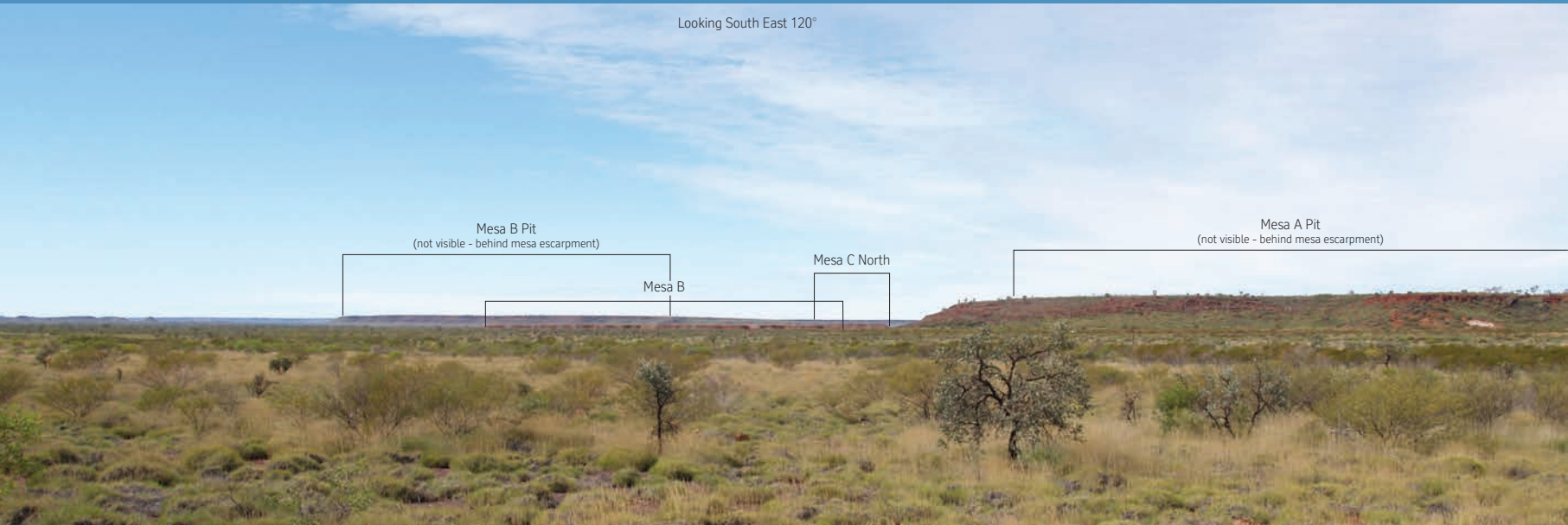
Name	#05 - NWCH05 - North West Coastal Highway
Co-ordinates	385172.92mE / 7606138.92mN
Direction	South East (Bearing 120°)
Description	Very flat ground with low vegetation coverage. South east view towards the Mesa.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the eastern side of the Highway.

Figure 18 - North West Coastal Highway

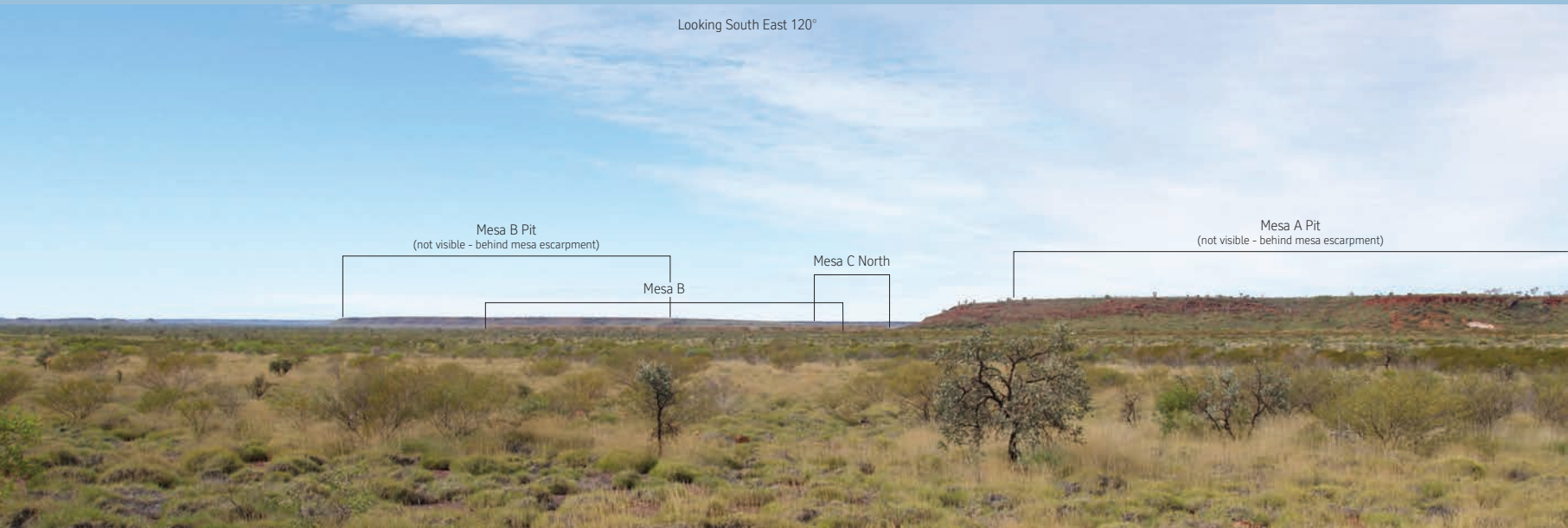
Current View



Operations View

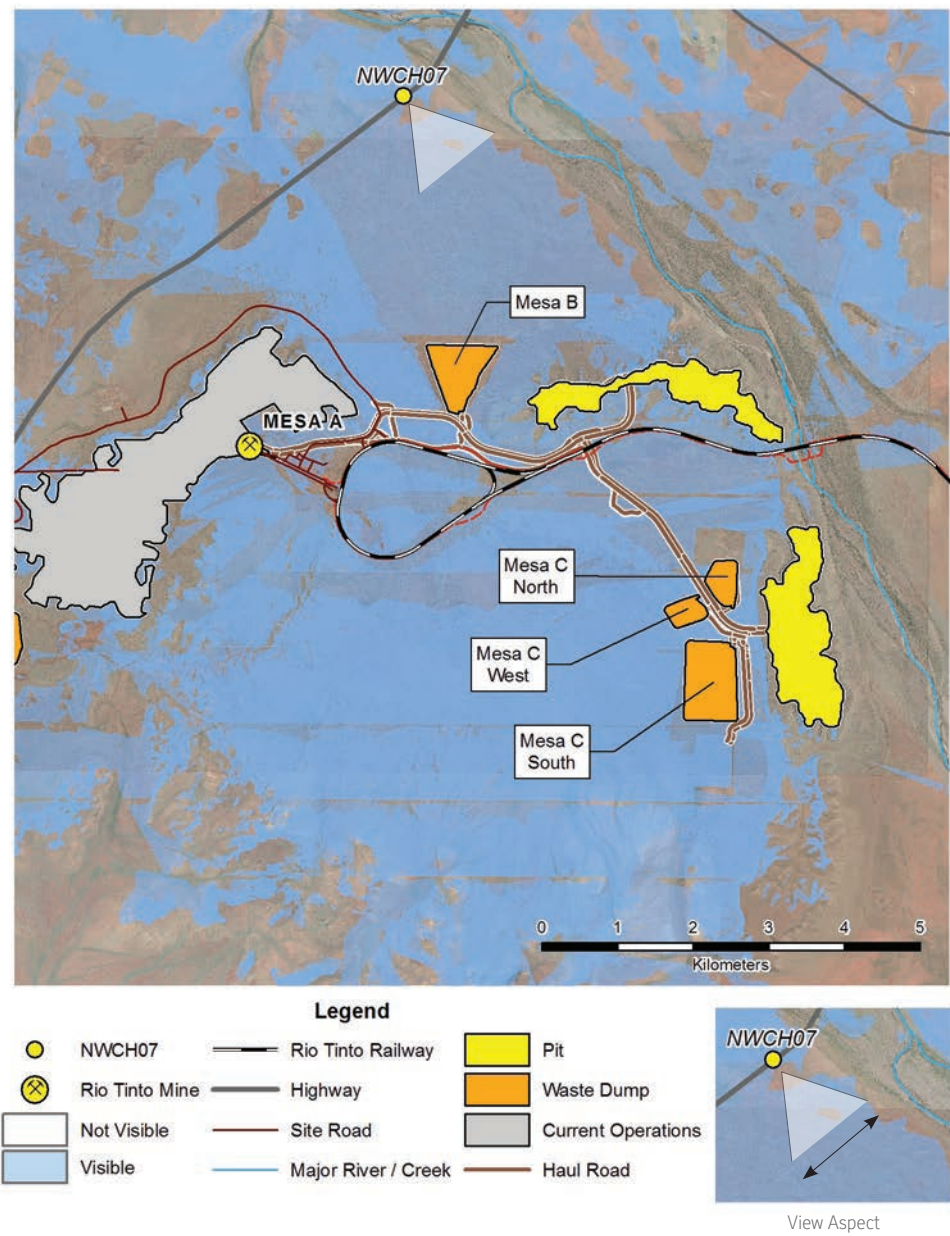


Closure View





Location Map



Viewpoint Characteristics

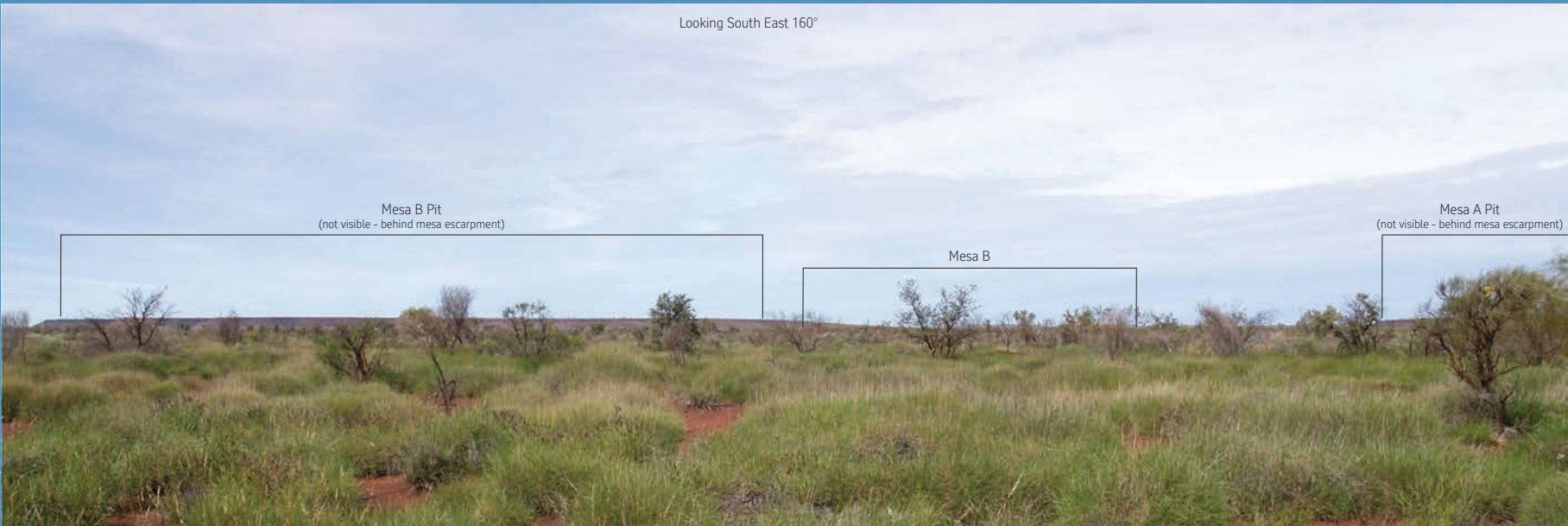
Name	#07 - NWCH07 - North West Coastal Highway
Co-ordinates	387768mE / 7608260.79mN
Direction	South East (Bearing 160°)
Description	Very flat ground with low vegetation coverage. South east view towards the Mesa A operations and train loadout.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the eastern side of the Highway.

Figure 19 - North West Coastal Highway

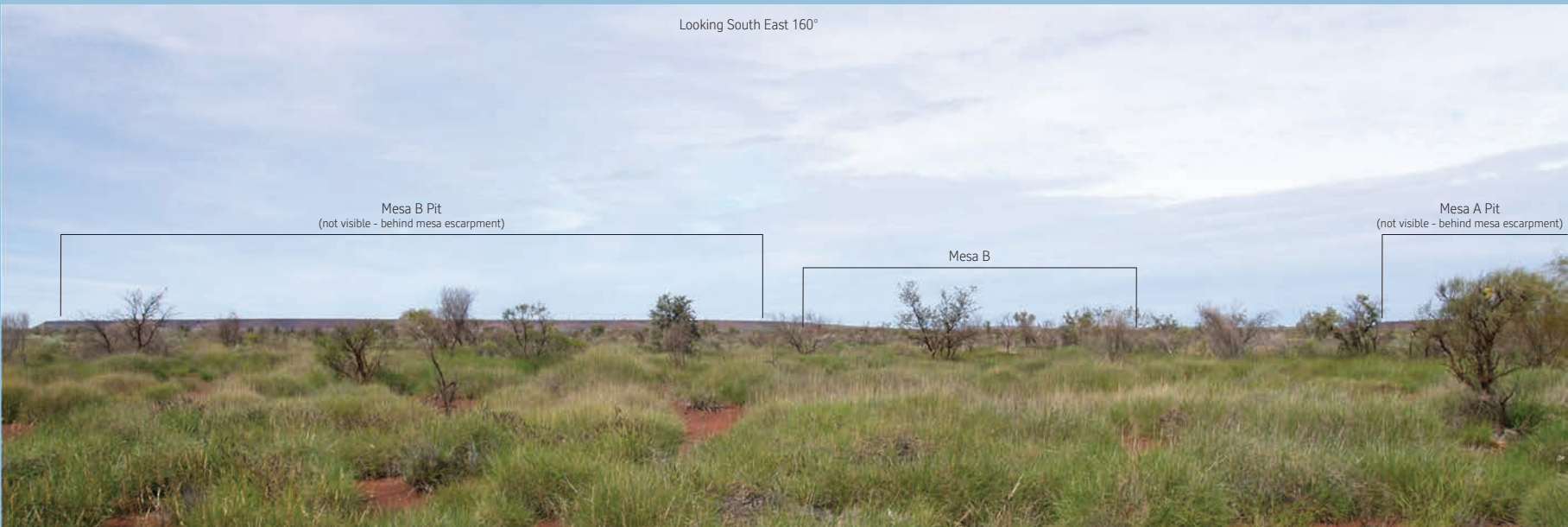
Current View



Operations View

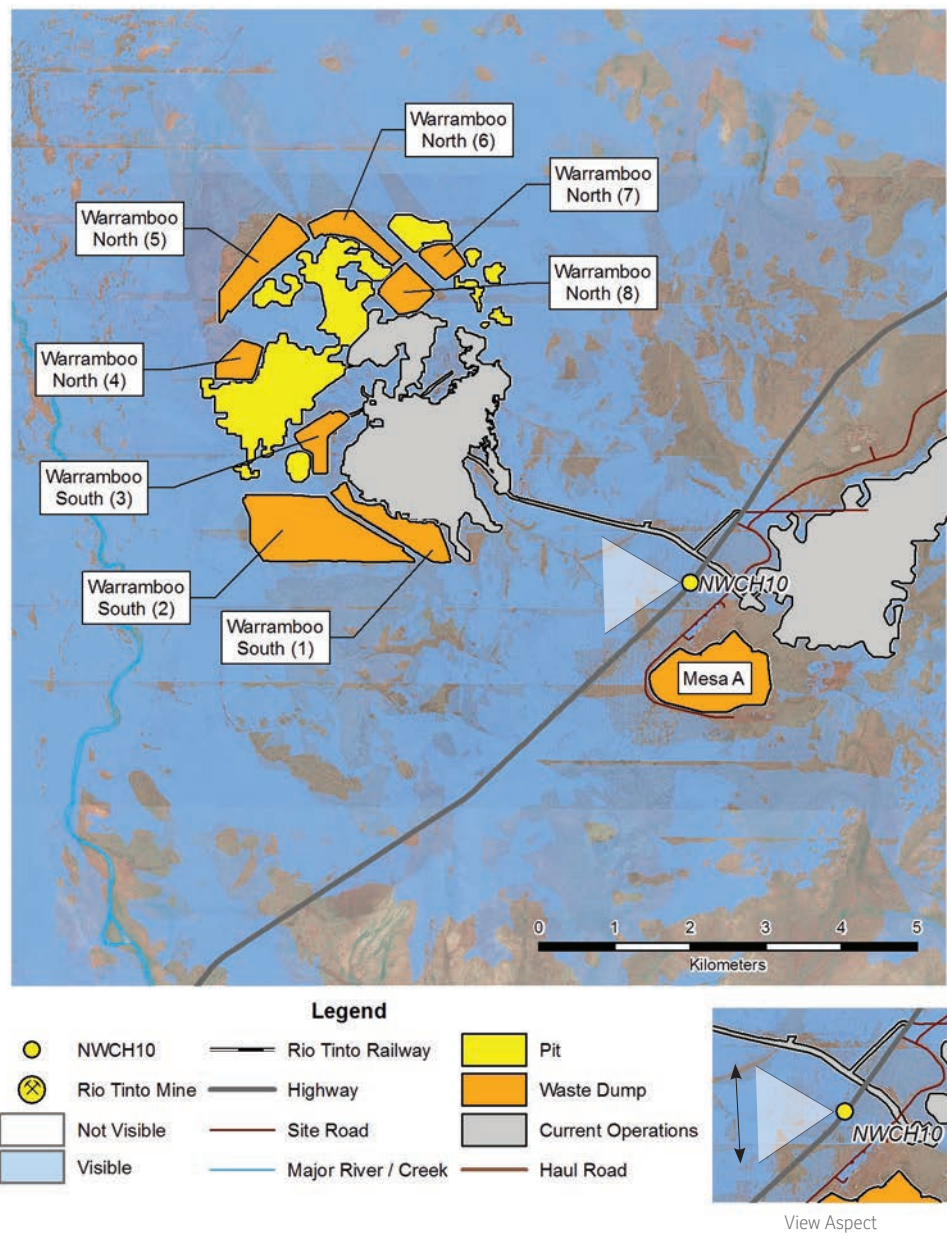


Closure View





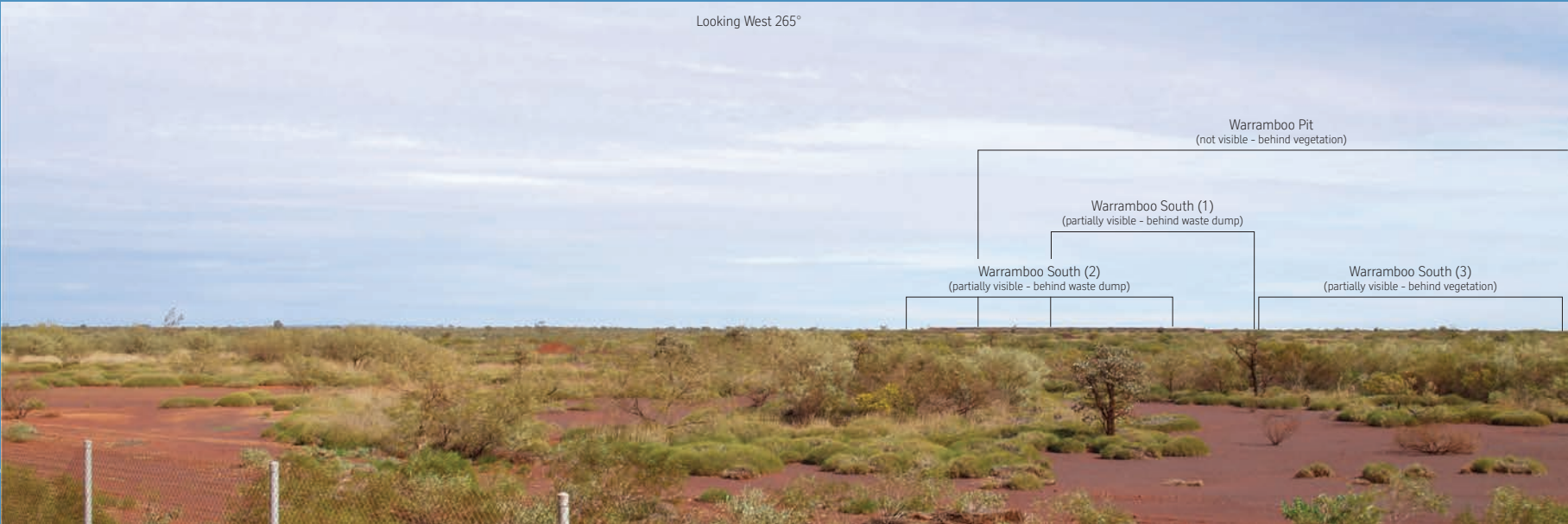
Location Map



Current View



Operations View

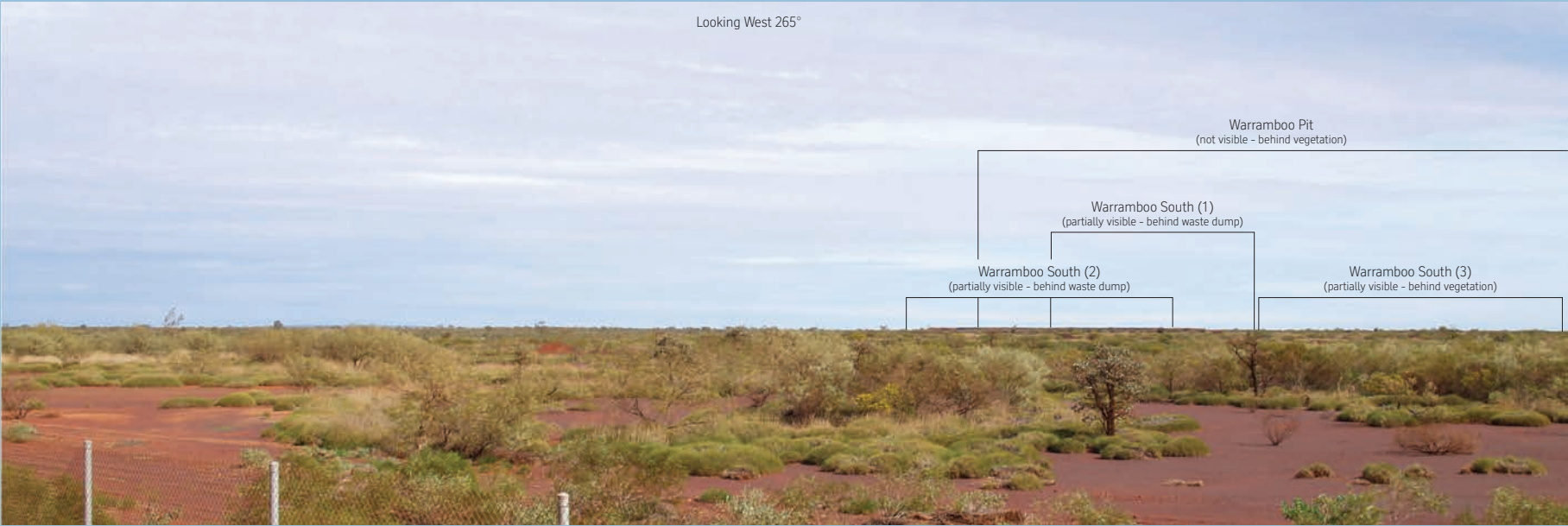


Viewpoint Characteristics

Name	#24 - NWCH10 - North West Coastal Highway
Co-ordinates	382126.04mE / 7602346.64mN
Direction	West (Bearing 265°)
Description	Elevated view towards existing Warrambo operations and low vegetation cover.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	Photo was taken on the western side of the highway, elevated on bridge over mine haul road.

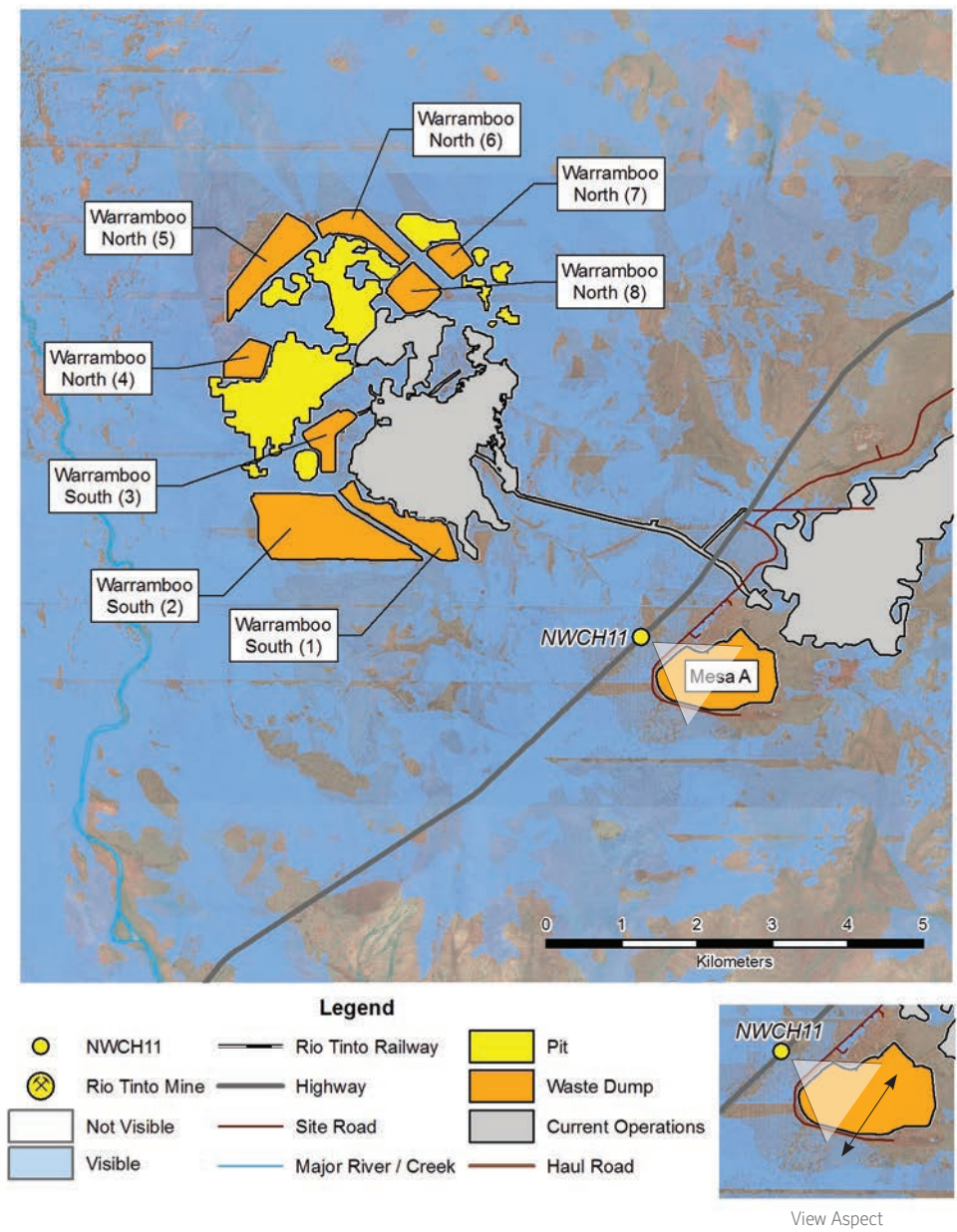
Figure 20 – North West Coastal Highway

Closure View





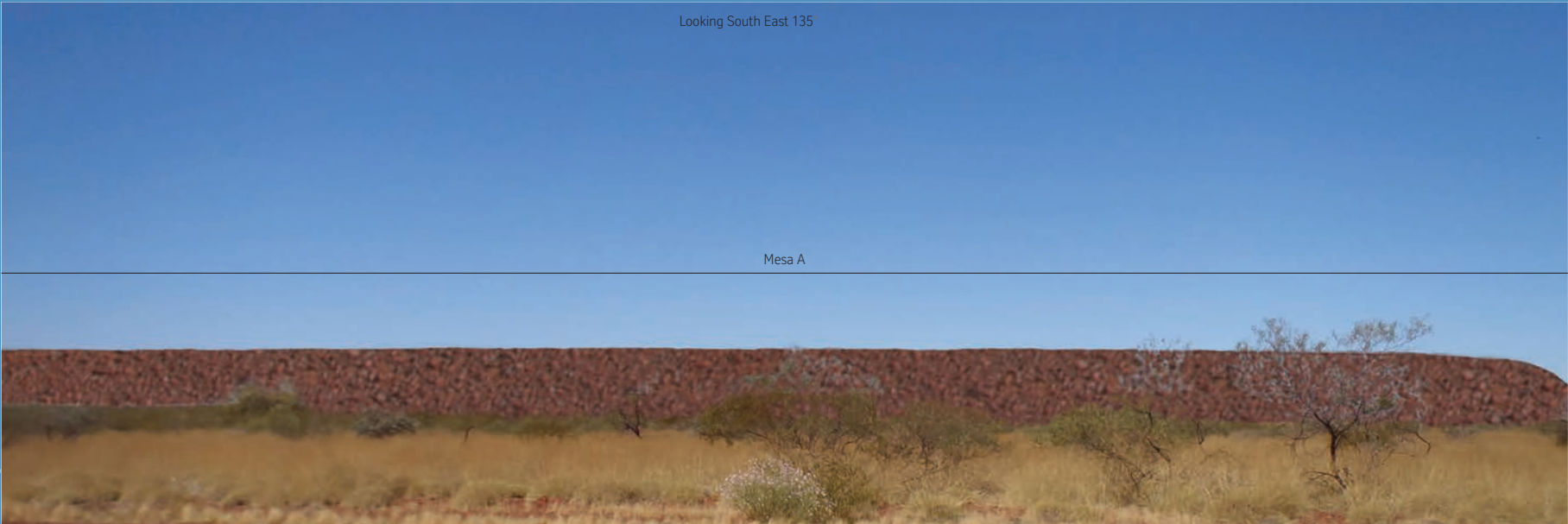
Location Map



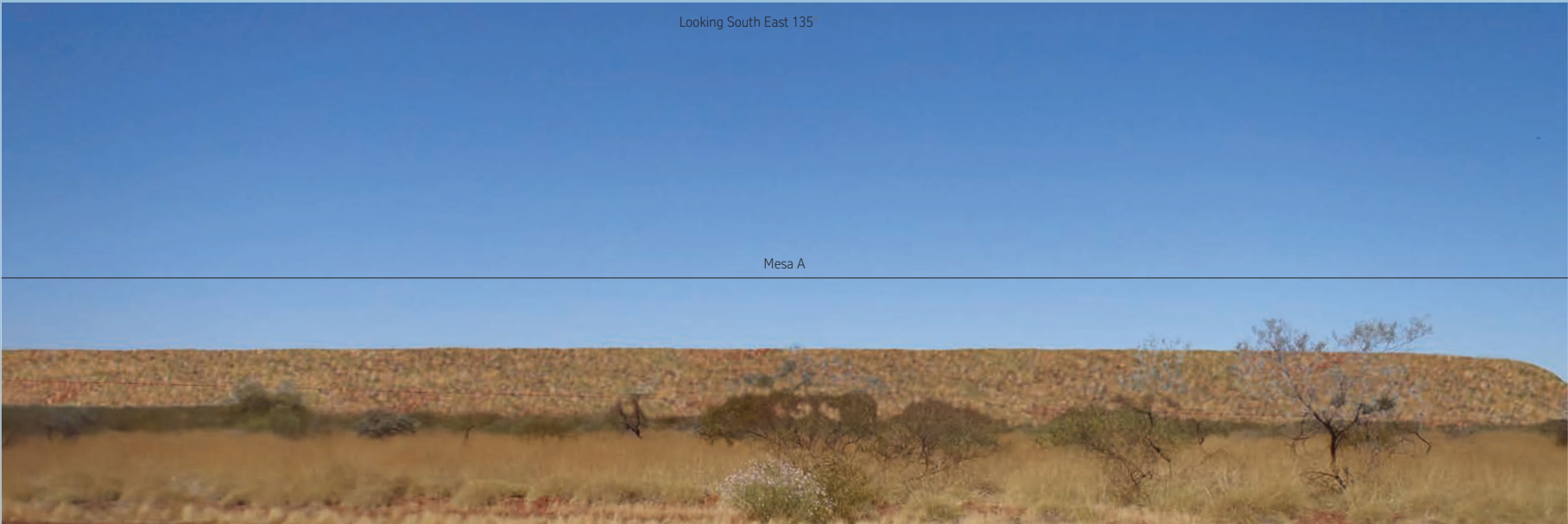
Current View



Operations View



Closure View



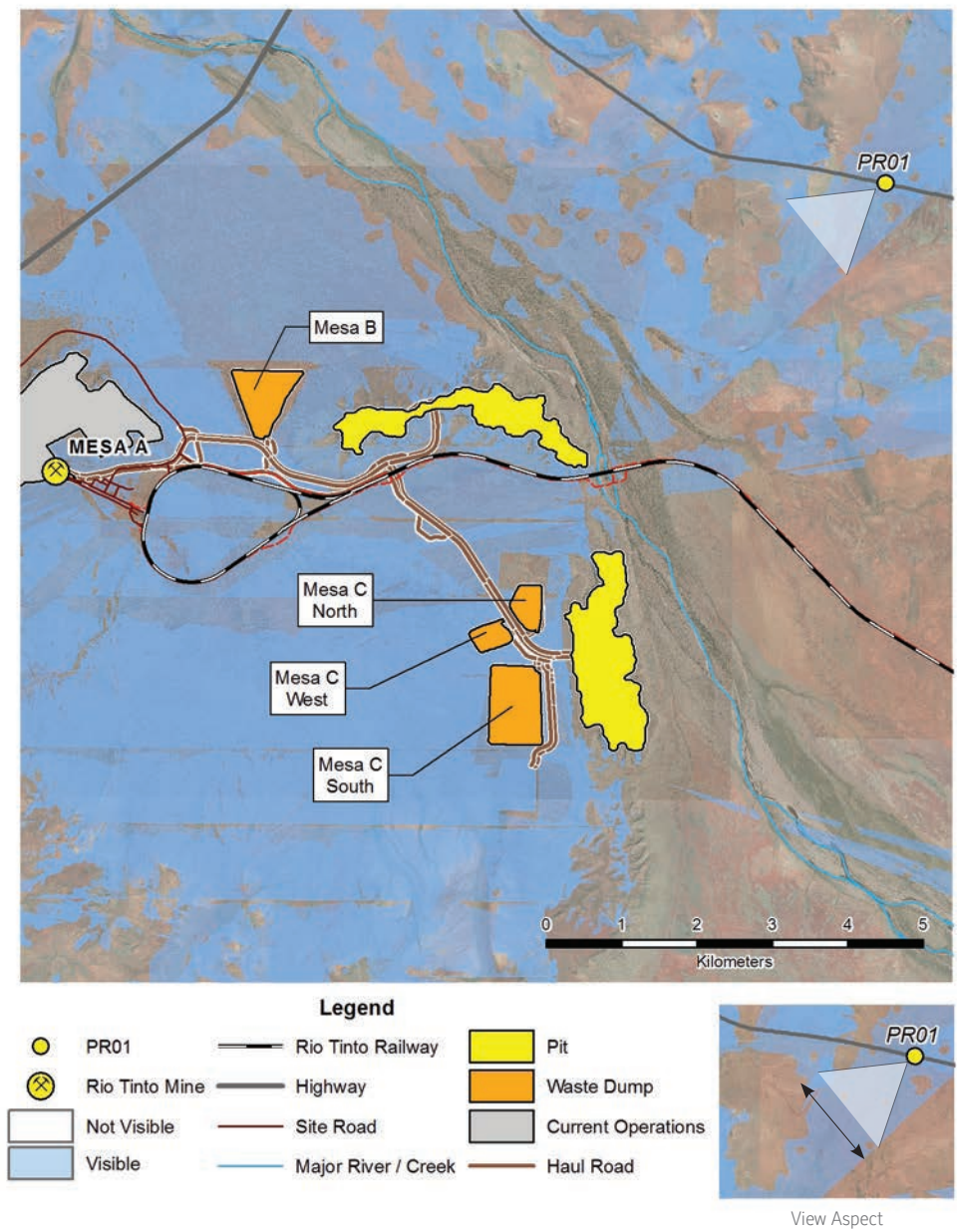
Viewpoint Characteristics

Name	#25 - NWCH11 - North West Coastal Highway
Co-ordinates	381,435.82mE / 7,601,602.52mN
Direction	South East (Bearing 135°)
Description	Very flat ground with low vegetation coverage.
Site Significance	Main state Highway between Canarvon and Karratha.
Comments	The photo was taken on the western side of the Highway looking at existing Mesa A Waste Dump

Figure 21 - North West Coastal Highway



Location Map



Viewpoint Characteristics

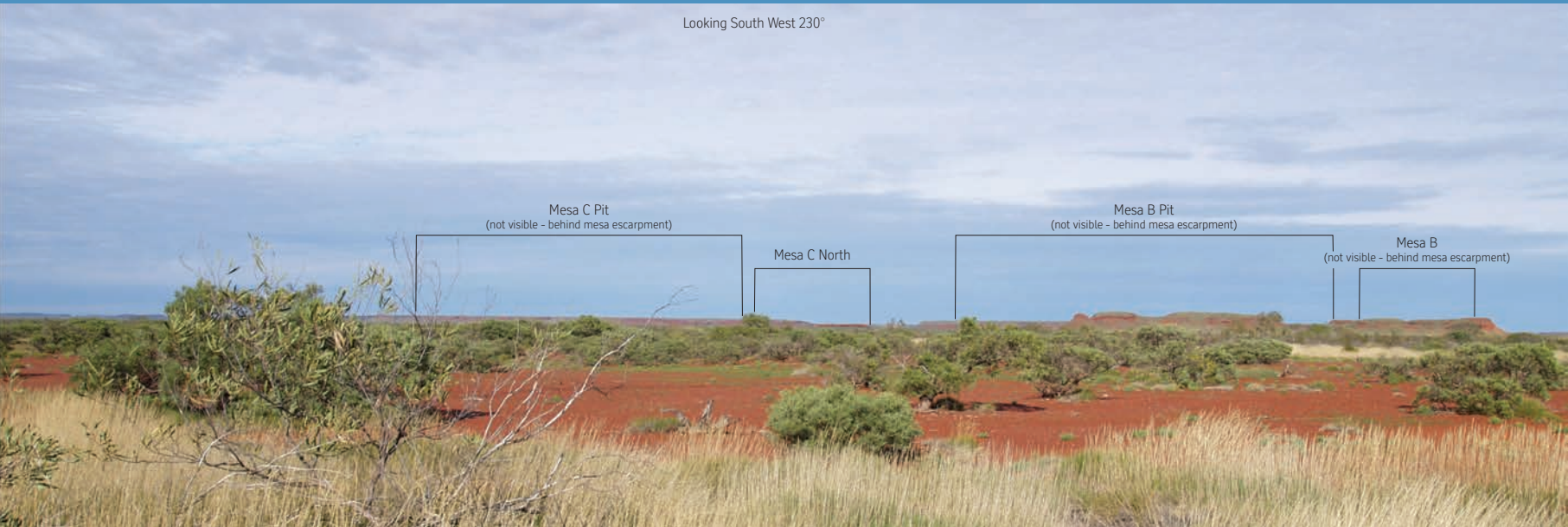
Name	#10 - PR01 - Pannawonica Road
Co-ordinates	396124mE / 7607509.89mN
Direction	South West (Bearing 230°)
Description	Very flat ground with low vegetation coverage. South west view towards Mesa B & C.
Site Significance	Major access road to the mining town of Pannawonica.
Comments	The photo was taken on the southern side of Pannawonica Road.

Figure 22 - Pannawonica Road

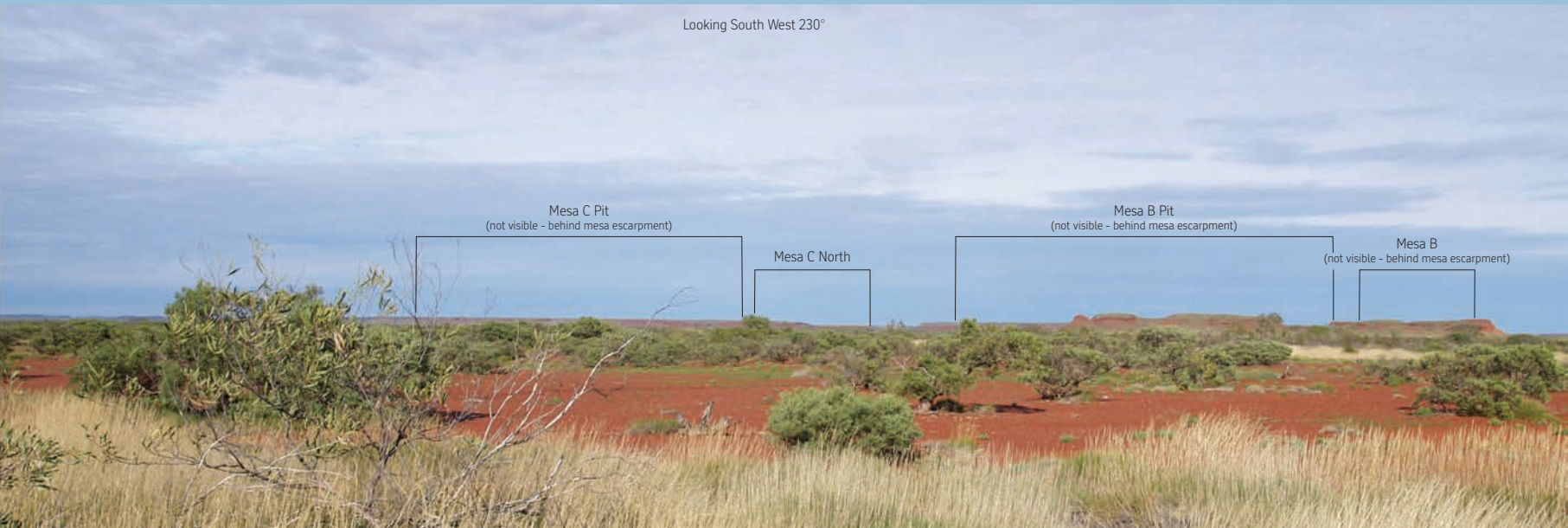
Current View



Operations View

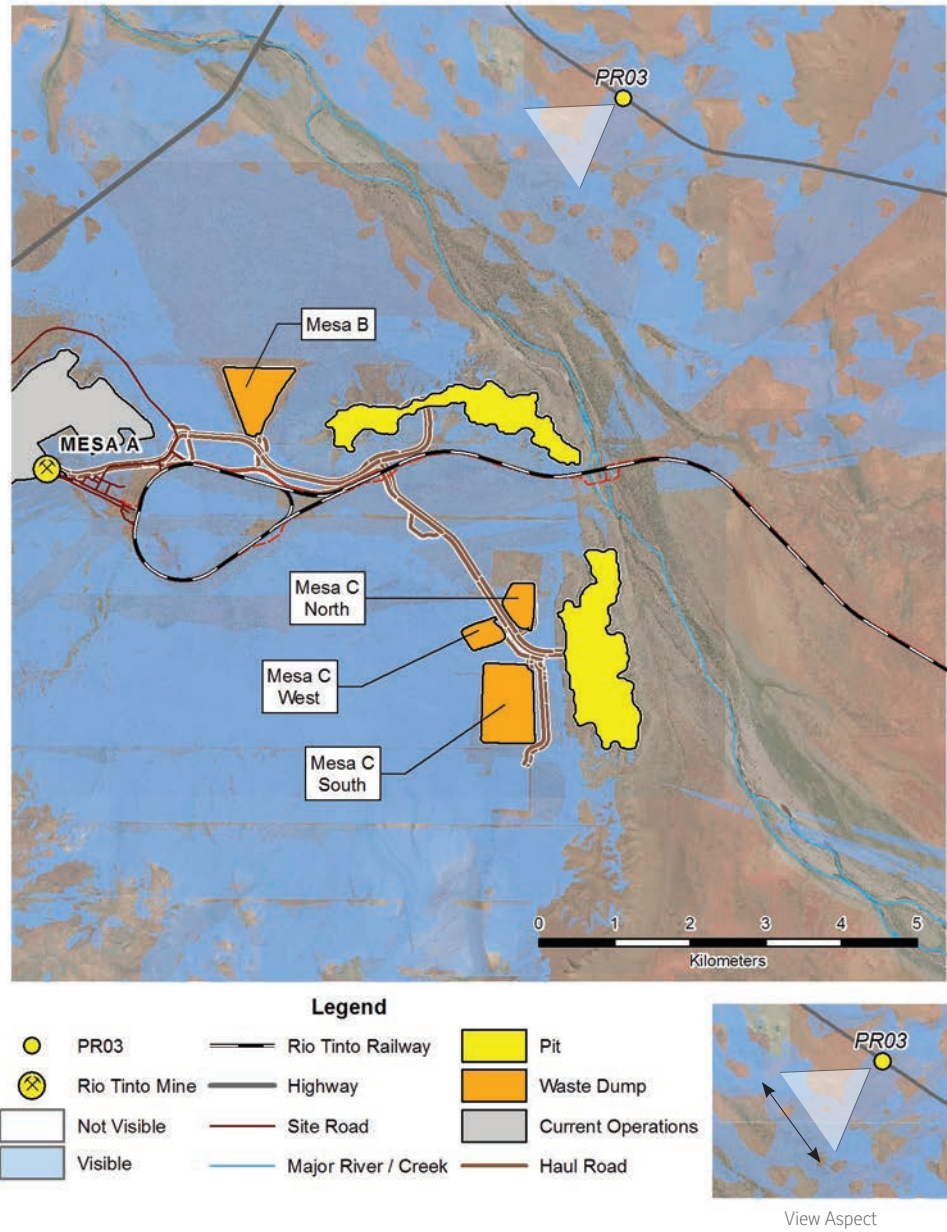


Closure View





Location Map

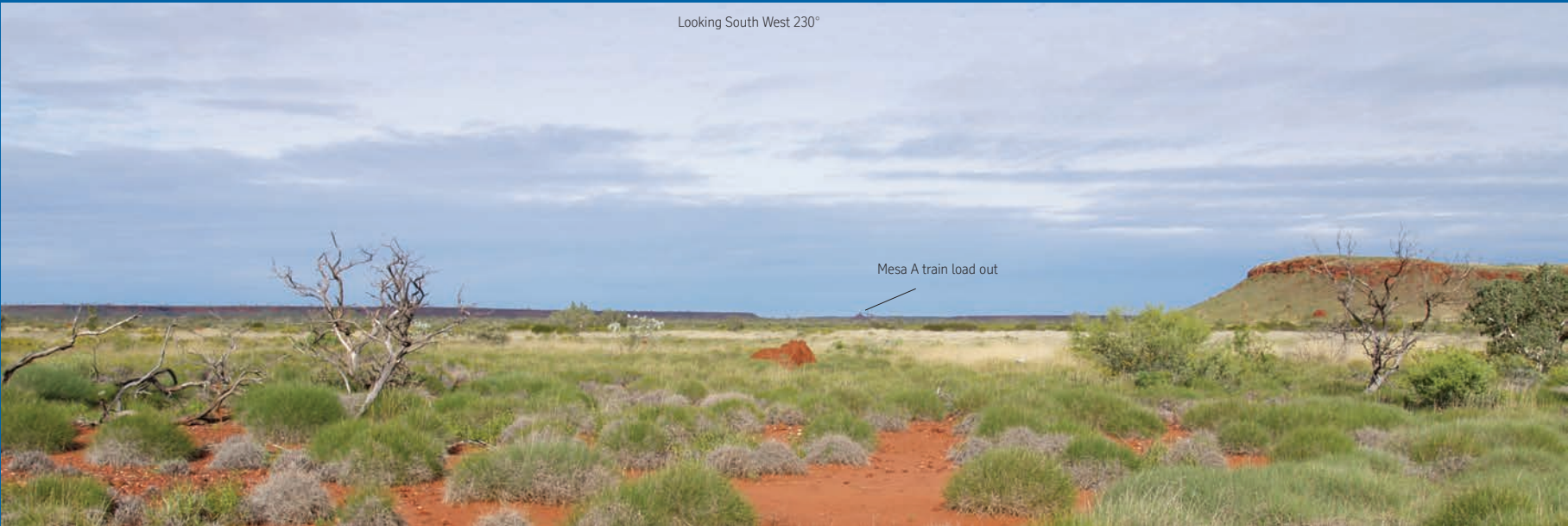


Viewpoint Characteristics

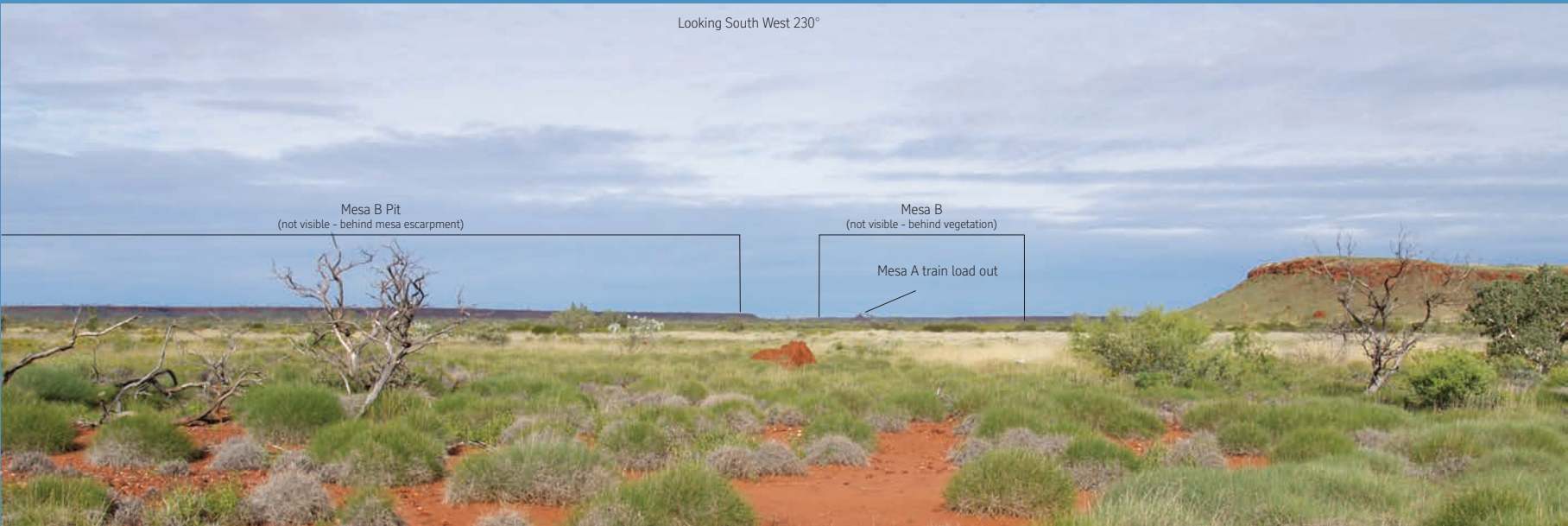
Name	#12 - PR03 - Pannawonica Road
Co-ordinates	392963.82mE / 7608562.29mN
Direction	South West (Bearing 230°)
Description	Very flat ground with low vegetation coverage. South west view with clear line of sight to Mesa A train loadout.
Site Significance	Major access road to the mining town of Pannawonica.
Comments	The photo was taken on the southern side of Pannawonica Road.

Figure 23 - Pannawonica Road

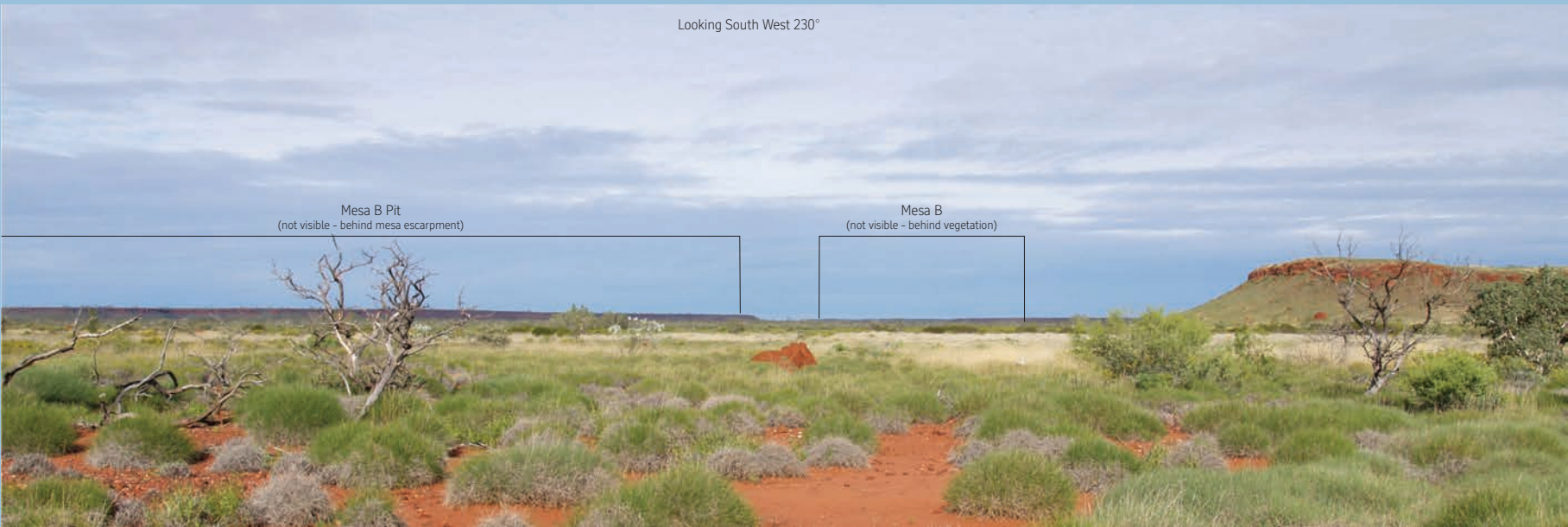
Current View



Operations View

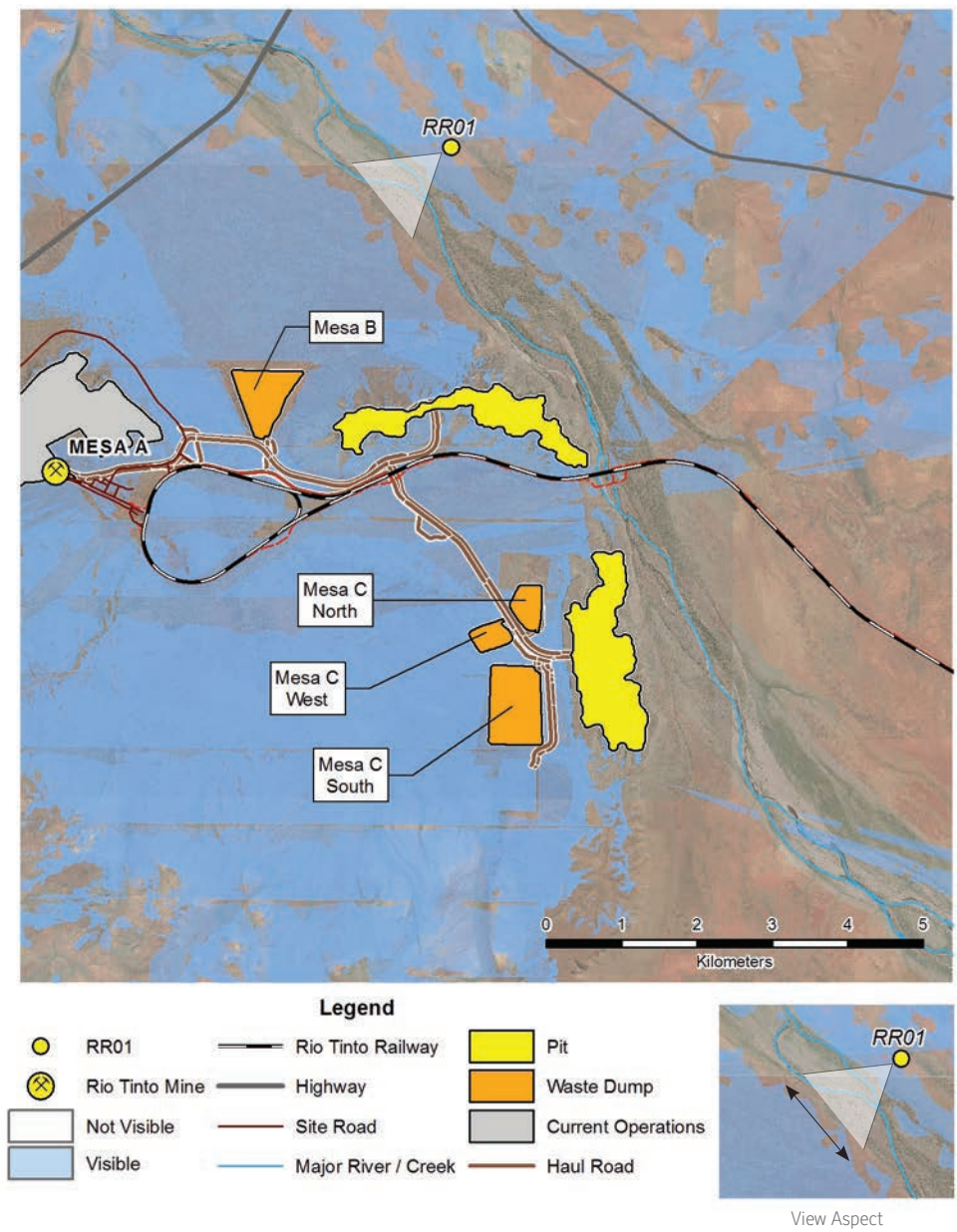


Closure View





Location Map



Viewpoint Characteristics

Name	#13 - RR01 - Robe River
Co-ordinates	390758.03mE / 7607943.97mN
Direction	South West (Bearing 230°)
Description	Very flat ground with low vegetation coverage. South west view, with limited visibility of Mesa B escarpment.
Site Significance	Main river in the Robe Valley. It is a significant site for traditional owners.
Comments	The photo was taken on the north side of the Robe River from access track.

Figure 24 - Robe River

Current View



Operations View

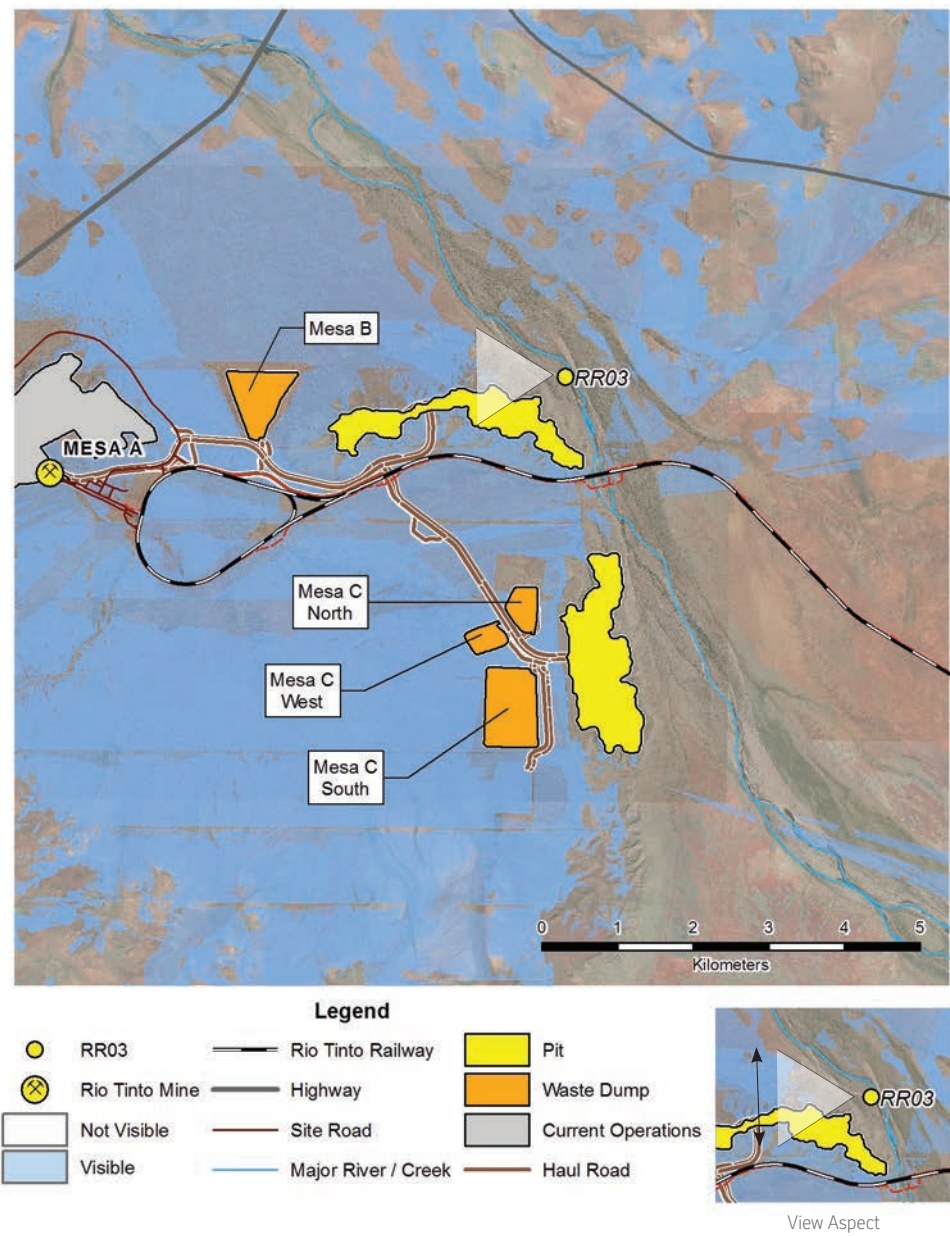


Closure View





Location Map



Viewpoint Characteristics

Name	#15 - RR03 - Robe River
Co-ordinates	392242.12mE / 7607943.97mN
Direction	West (Bearing 270°)
Description	Very flat ground with low vegetation coverage. South west view towards Mesa B escarpment and Robe River bed.
Site Significance	Main river in the Robe Valley. It is a significant site for traditional owners.
Comments	The photo was taken on the north side of the Robe River from access track.

Figure 25 - Robe River

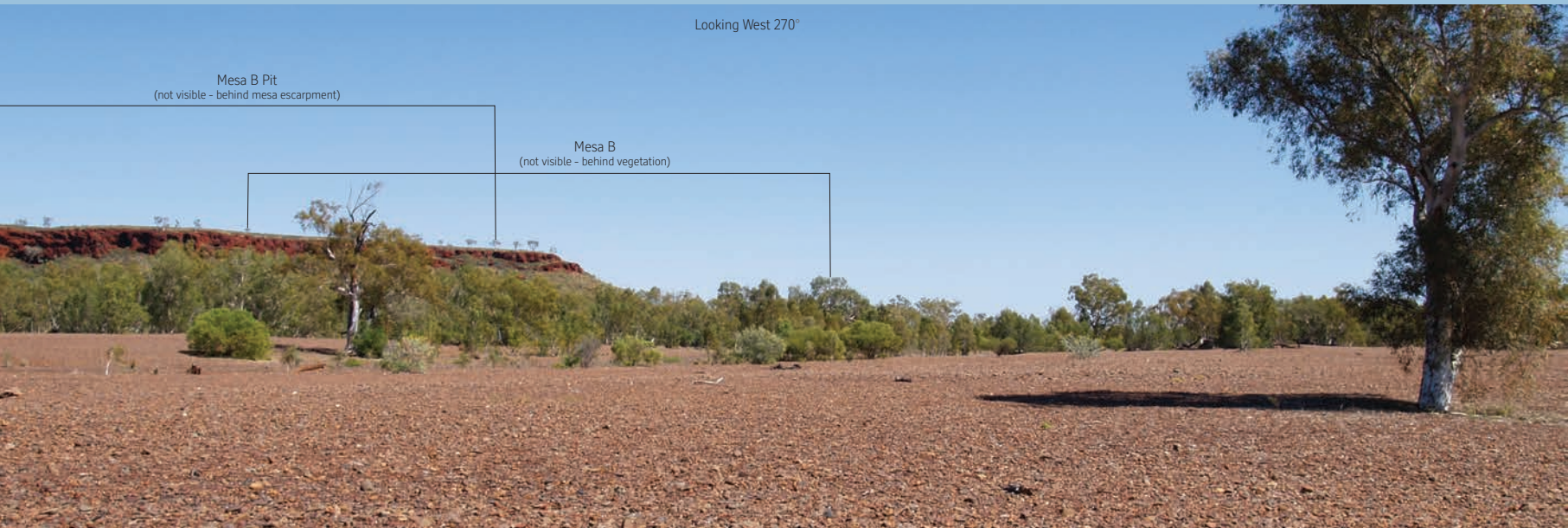
Current View



Operations View

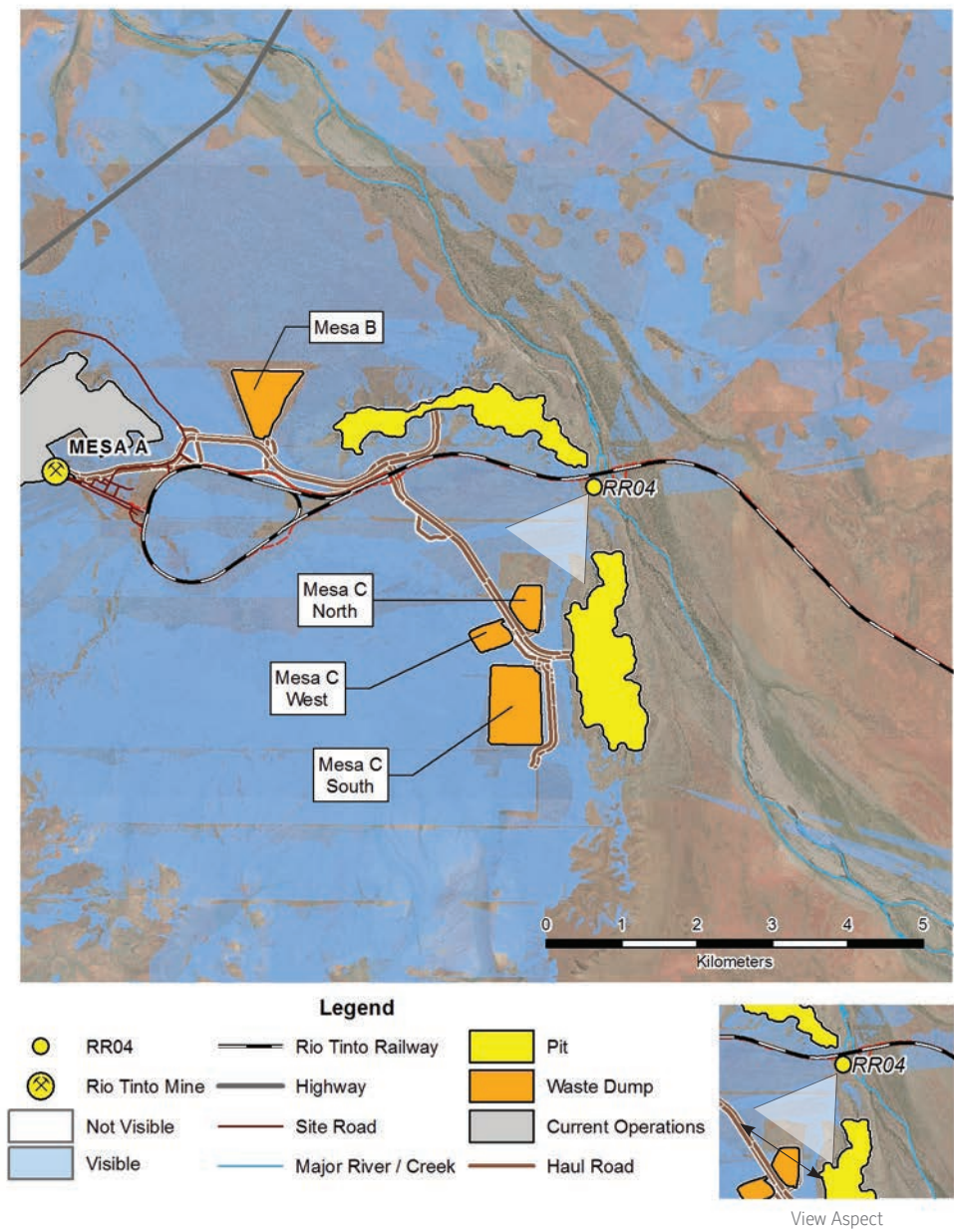


Closure View





Location Map



Viewpoint Characteristics

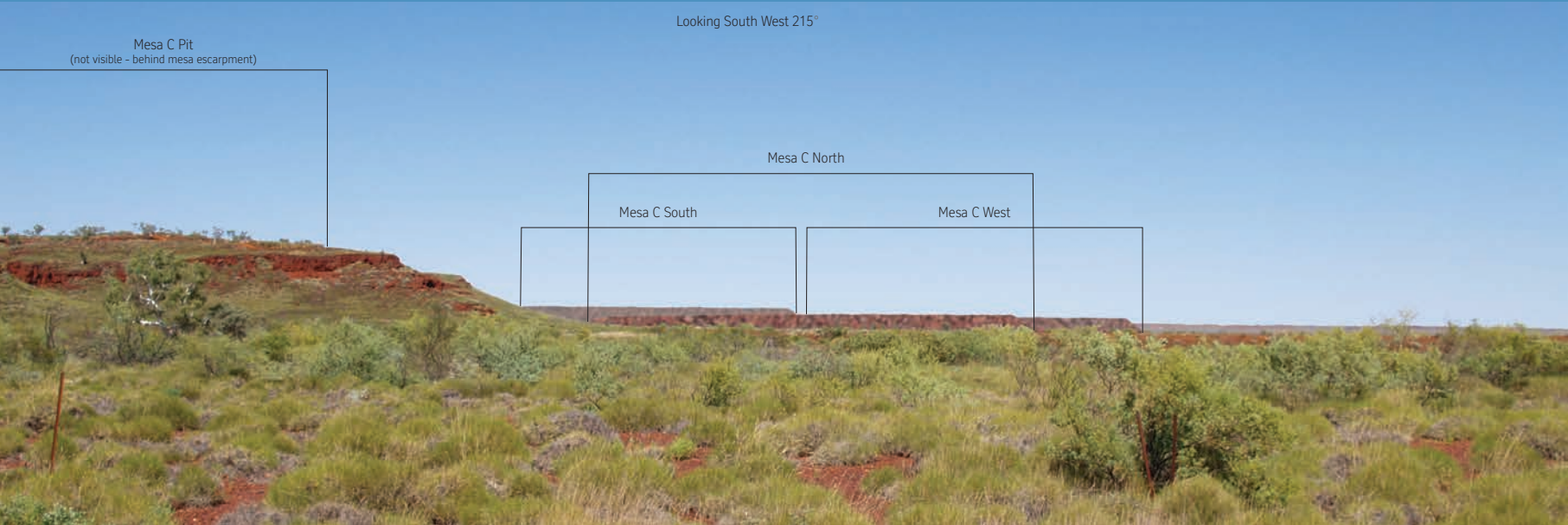
Name	#16 - RR04 - Robe River
Co-ordinates	392549.85mE / 7603480.11mN
Direction	South West (Bearing 215°)
Description	Slight elevation with moderate vegetation coverage. South west view towards Mesa C escarpment and next to Robe River bed.
Site Significance	Main river in the Robe Valley. It is a significant site for traditional owners.
Comments	The photo was taken on the south side of the Robe River, from access track on southern side of Rio Tinto railway.

Figure 26 - Robe River

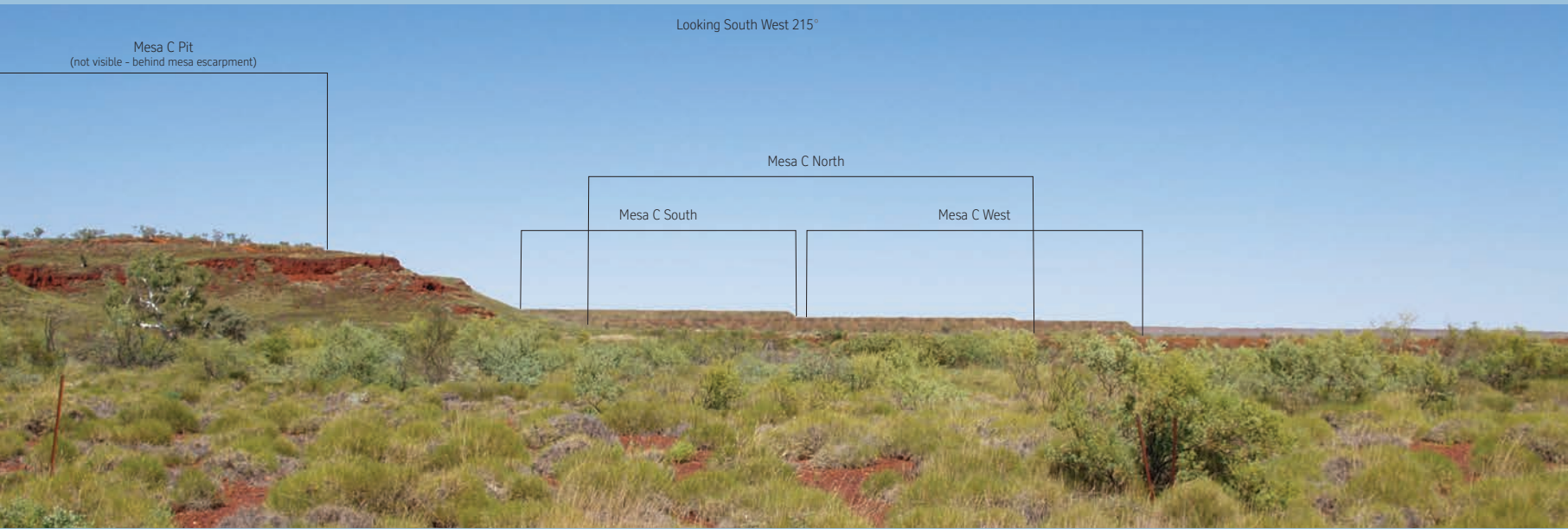
Current View



Operations View

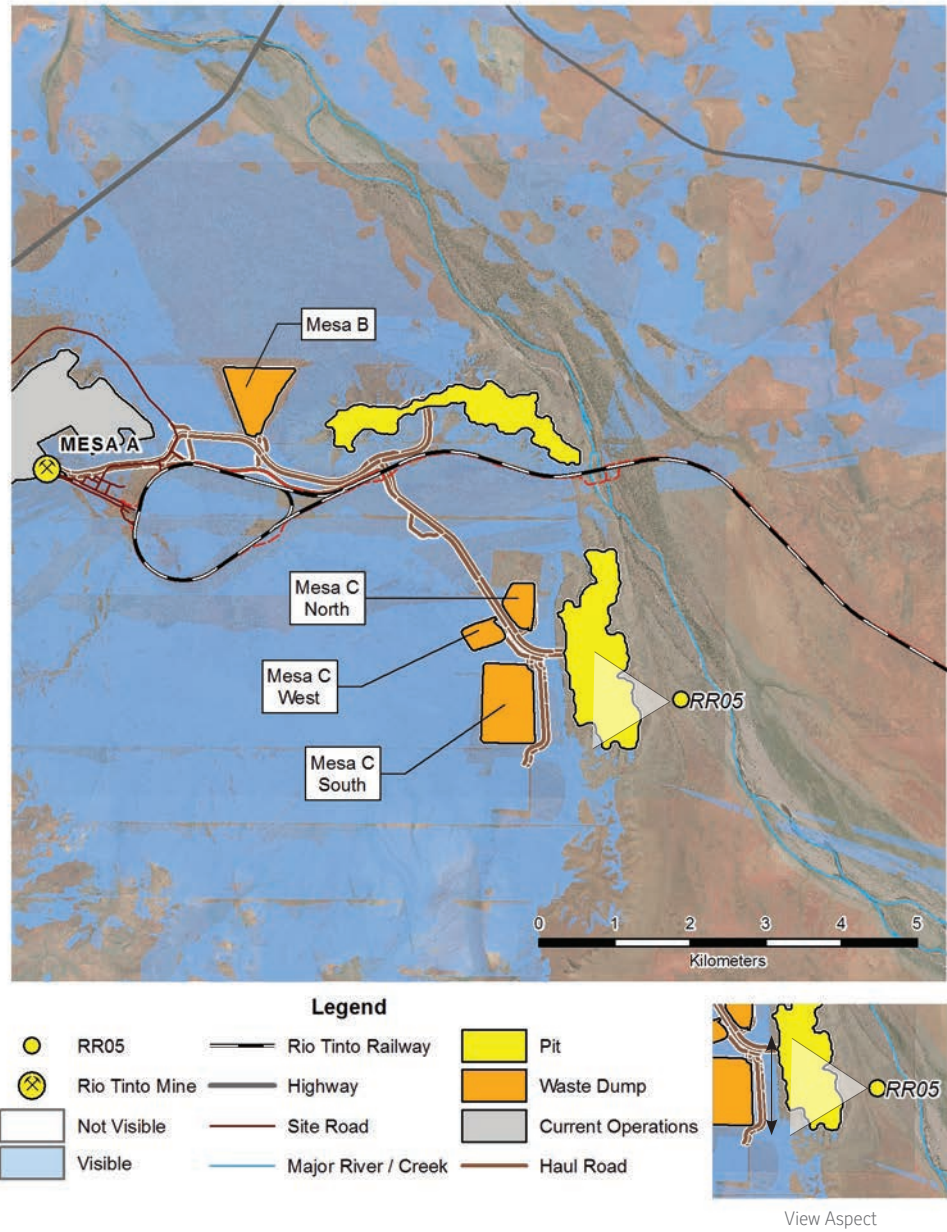


Closure View





Location Map



Viewpoint Characteristics

Name	#17 - RR05 - Robe River
Co-ordinates	393728.96mE / 7600652.89mN
Direction	West (Bearing 270°)
Description	Slight elevation with low vegetation coverage. Looking directly at Mesa C escarpment.
Site Significance	Main river in the Robe Valley. It is a significant site for traditional owners.
Comments	The photo was taken on the western side of the Robe River, clearly showing no visibility of western side of Mesa C.

Figure 27 - Robe River

Current View



Operations View

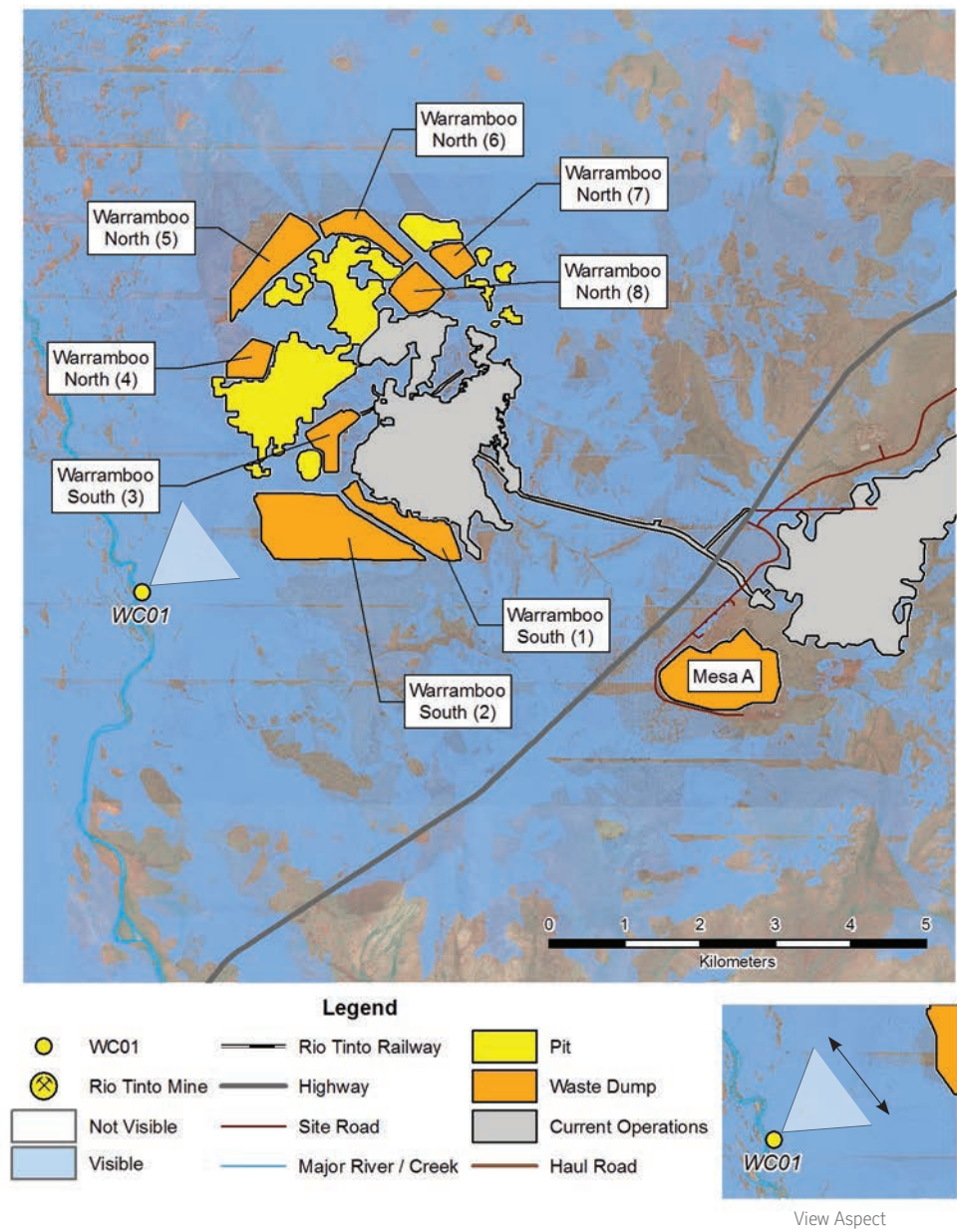


Closure View





Location Map



Viewpoint Characteristics

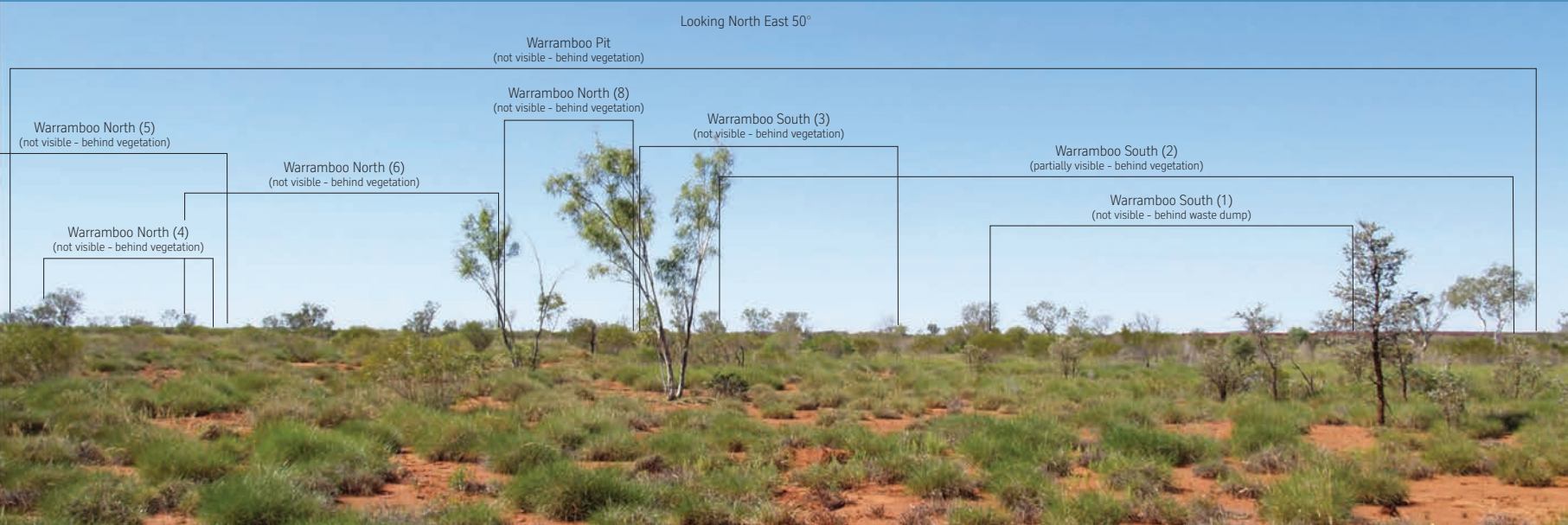
Name	#19 - WC01 - Warrambo Creek
Co-ordinates	375247.87mE / 7602141.5mN
Direction	North East (Bearing 50°)
Description	Flat ground with vegetation cover.
Site Significance	Minor creek in the Robe Valley. It is a significant site for traditional owners.
Comments	Taken from north side of Warrambo Creek, looking north east towards proposed infrastructure.

Figure 28 - Warrambo Creek

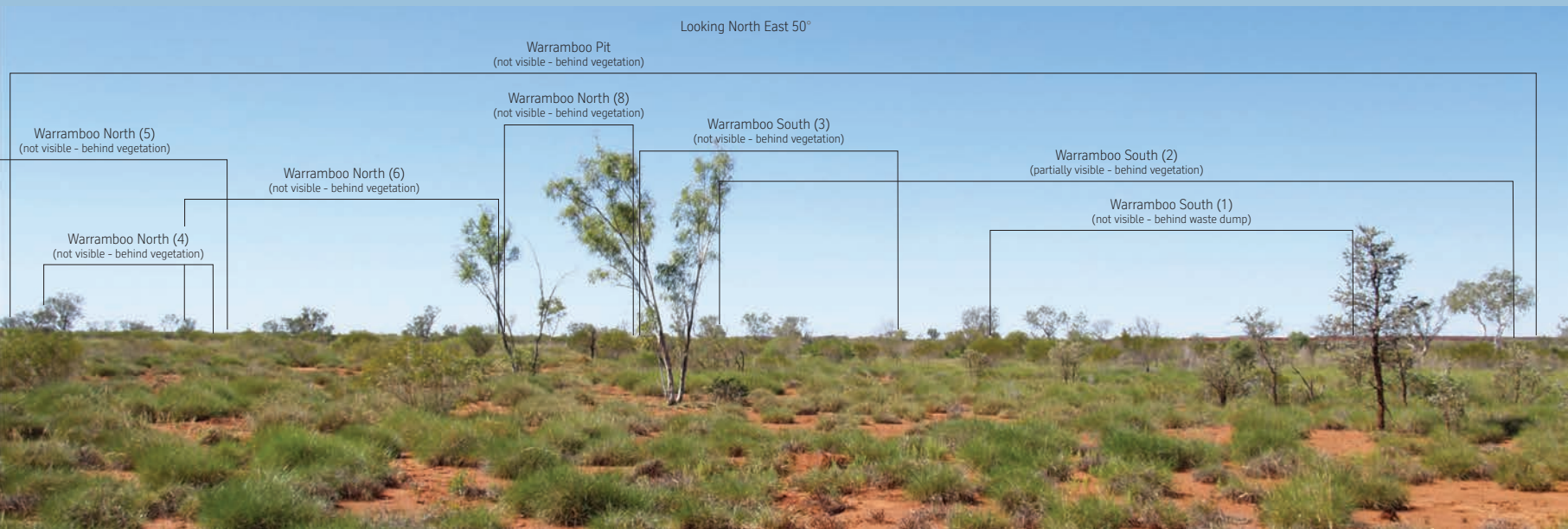
Current View



Operations View

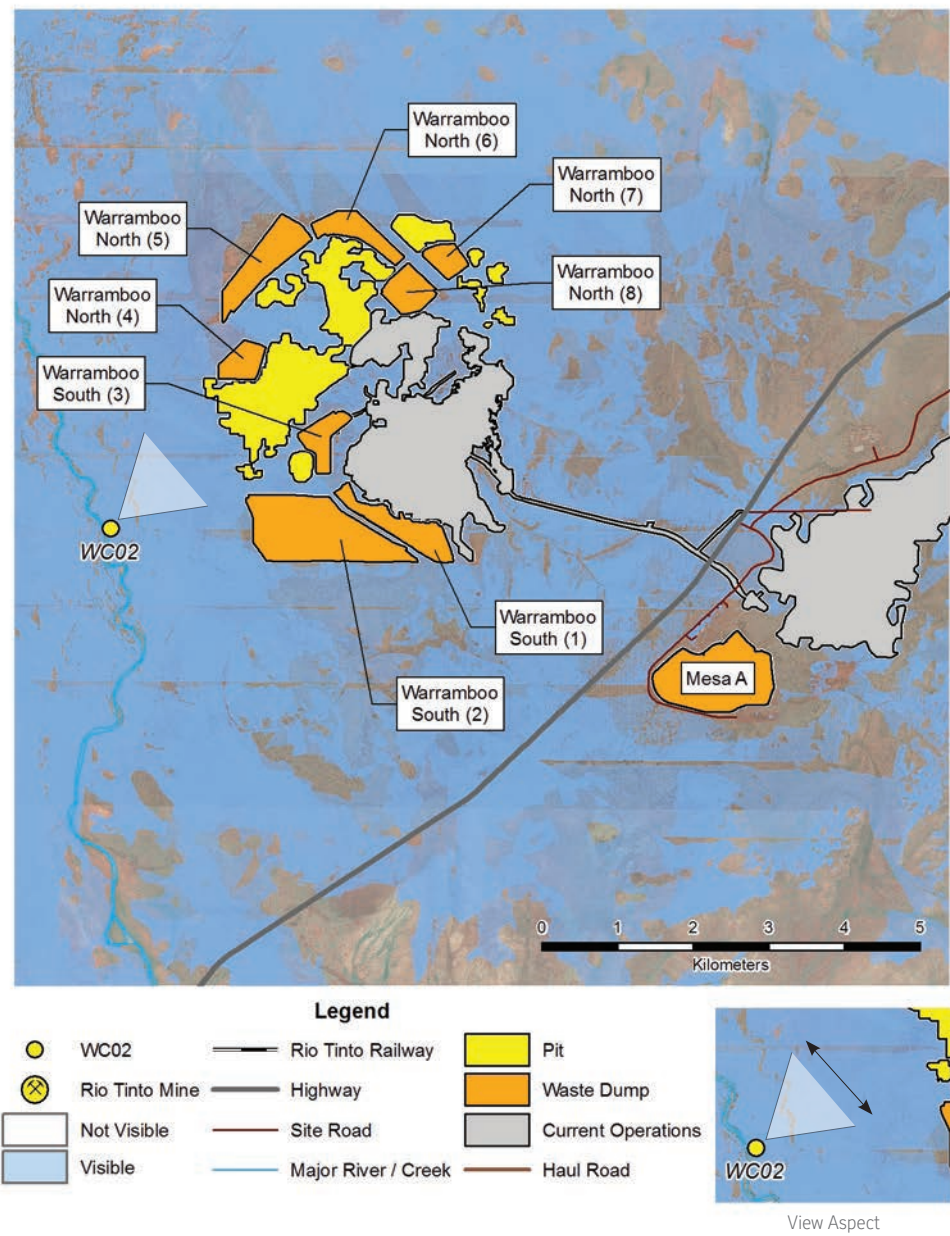


Closure View





Location Map



Viewpoint Characteristics

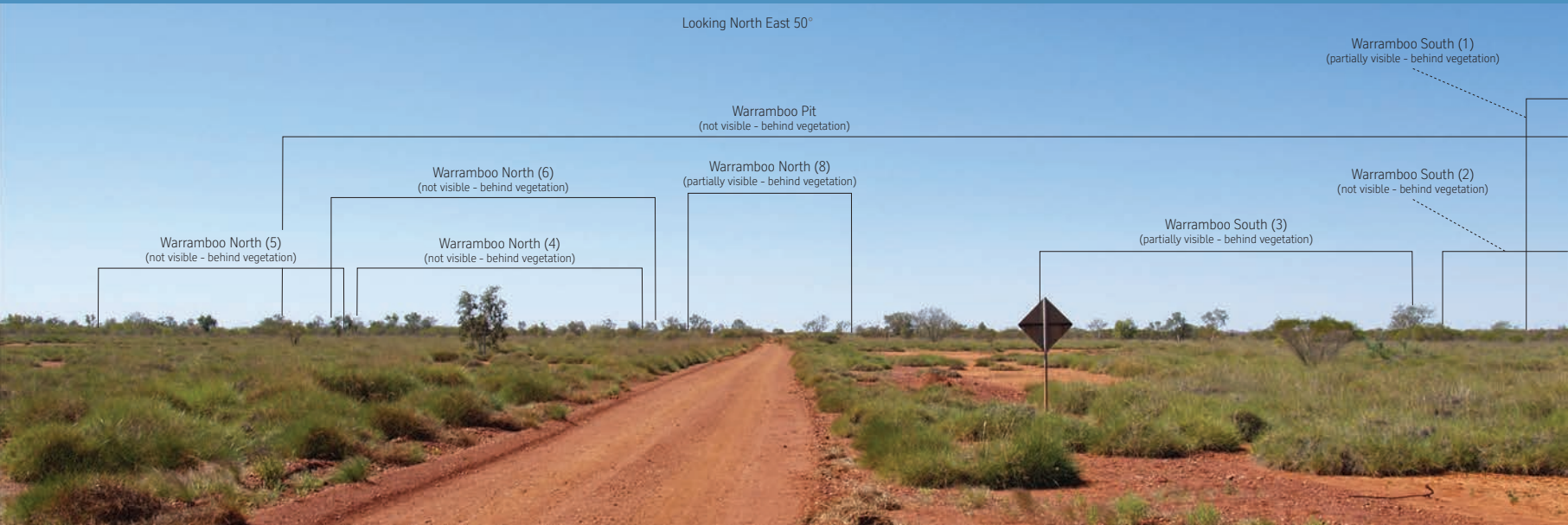
Name	#20 - WC02 - Warramboo Creek
Co-ordinates	374954.35mE / 7603000.83mN
Direction	North East (Bearing 50°)
Description	Flat ground with vegetation cover.
Site Significance	Minor creek in the Robe Valley. It is a significant site for traditional owners.
Comments	Taken from north side of Warramboo Creek, looking north east down track (old NWCH) towards Warramboo.

Figure 29 - Warramboo Creek

Current View



Operations View

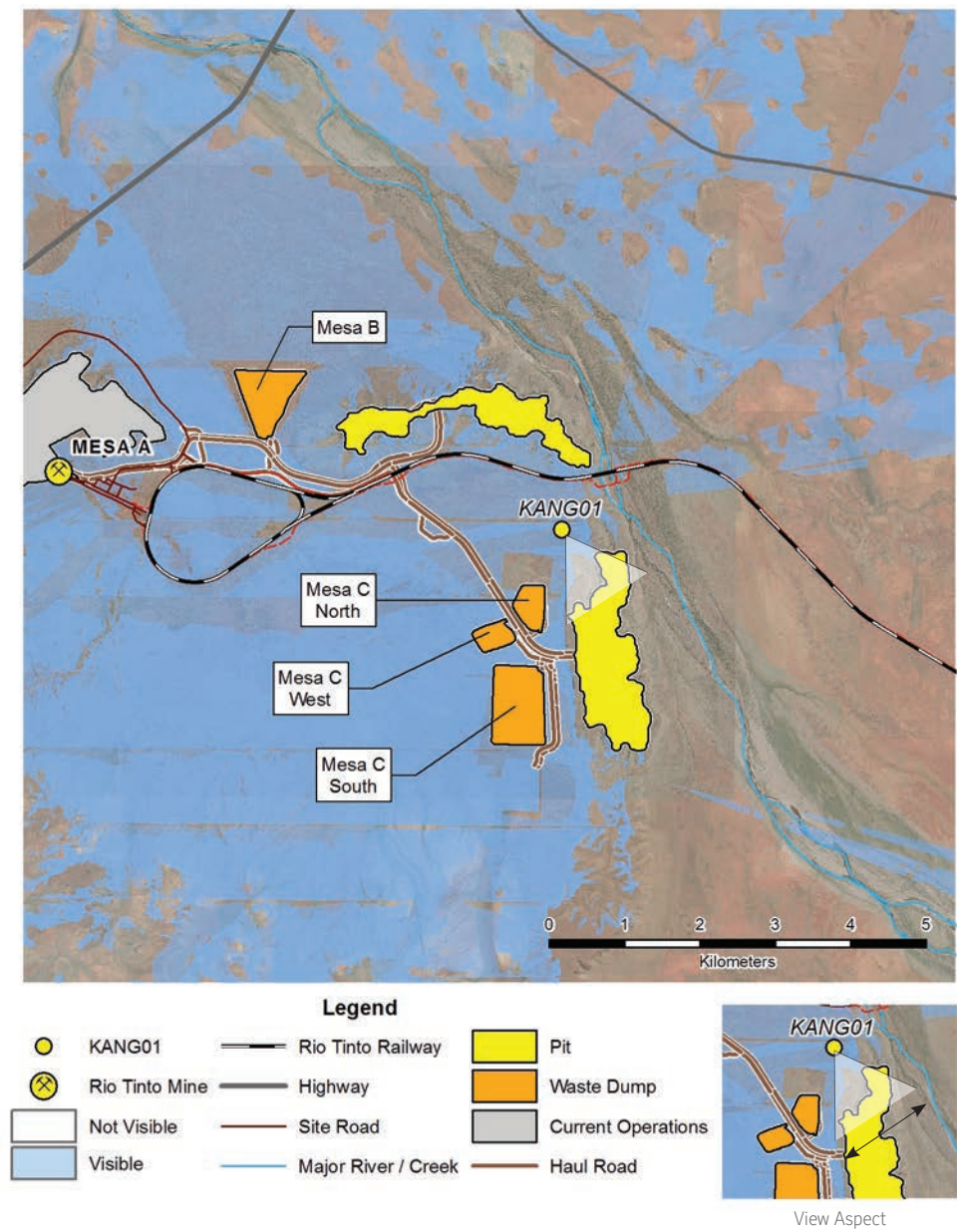


Closure View





Location Map



Viewpoint Characteristics

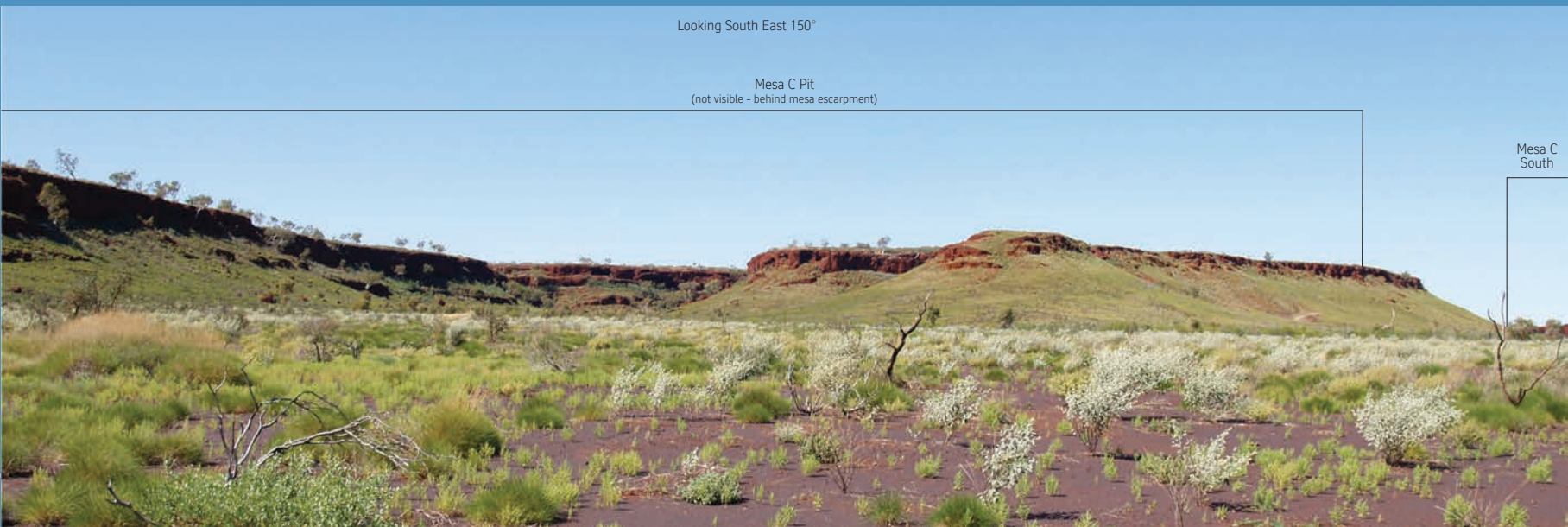
Name	#23 - KANG01
Direction	South East (Bearing 150°)
Description	Flat ground with vegetation cover. Looking directly at Mesa C escarpment.
Site Significance	Located in the Mesa C escarpment.

Figure 30 – Kang

Current View



Operations View



Closure View





Drawn: T.Linklater  
Plan: PDE0157521v1  
Date: January 2018

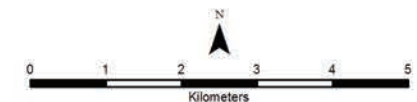
Proj: GDA 1994 MGA Zone 50  
Scale: 1:100,000 @ A4  
gisteam@riotinto.com

### Legend

-  Rio Tinto Railway
-  Highway
-  Major Road
-  Site Road
-  Rail Access Road
-  Major River / Creek

### Proposed Mine Layout

-  Pit
-  Waste Dump / Stockpile
-  Topsoil Stockpile
-  Current Operations
-  Haul Road



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